OCTOBER

# THE JOURNAL OF THE AMERICAN DENTAL ASSOCIATION

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## Original Communications

# A MODERN CONCEPT OF ORTHODONTIA*

By FRANK M. CASTO, Ph.G., M.D., D.D.S., Cleveland, Ohio

TO those interested in the practice of orthodontia, a knowledge of the history of this science is indispensable. It is important not only because it gives a proper perspective to the real student, but also because it forms a basis upon which much of the future progress in orthodontia will be founded.

A detailed history of orthodontia is not the purpose of this paper, and would in fact be but a repetition of the material which can be found in the many published articles dealing with the historical aspect of the science. Therefore, mention of but a few incidents must suffice.

Perhaps the best and most comprehensive of the historical articles is the work of B. W. Weinberger. His treatise, published in two volumes, in 1926, is entitled, "Orthodontia—An Historical Review of Its Origin and Evolution." This edition, although abridged, gives one a clear vision of the important events of the past and is recommended to those who desire to know the primary principles upon which orthodontia was founded.

The first authentic description of orthodontic appliances and their uses may be found in a treatise on dentistry by a Frenchman, Pierre Fauchard, published in 1728. Since that date, there has been a continuous progressive evolution both in the science of constructing appliances and in the art of applying them.

A few of the outstanding pioneers in this early period who contributed in this respect were Boudet (1757), Fox (1803), Delabarre (1819) and Schange (1846). In more recent years, Kingsley, Farrar, Guilford, Ainsworth, Baker, Case, Jackson, and Angle are among those who have made valuable contributions.

That the study and understanding of the fundamental laws of nature is more important to successful orthodontic treatment than the application of mechanical devices is now academic. This maxim

*Read before the Massachusetts State Society meeting May 3, 1933, at Boston, Mass.

has long been recognized, since, from the beginning, the study of biologic problems in orthodontia closely parallels the development of mechanical devices. Hunter (1771), Woofendale (1783), Blake (1798), McQuillan (1859), Sylvester (1863) and Coleman (1865) are only a few of the pioneers who investigated and discussed many of the biologic problems with which the orthodontist is confronted, and in which he is so greatly interested.

In the scientific trend of orthodontia, two distinct phases have always been recognized, the biologic and the mechanical. In practice, the mechanical phase has been overemphasized. This has been unfortunate, since it has not only retarded progress but has also been the cause of many failures in treatment. These phases are so closely related that a clear conception of both is necessary to those who desire to engage in orthodontic practice, if successful results are to be obtained.

Notwithstanding the fact that many writers were beginning to recognize and treat orthodontia as a science distinct from general dentistry, it was not until late in the last century that it became a separate and special course of study in the curriculum of the dental school. Even after the year 1890, many schools continued to follow the old practice of giving orthodontic instruction as a part of prosthetics. This instruction was confined entirely to the mechanical phase of the science, and was usually given by inexperienced and incompetent instructors.

Most dental schools have, in recent years, improved the orthodontic courses given the undergraduates by broadening the field of study, by endeavoring to better organize the material offered and by acquiring more competent instructors. These efforts have not yet produced a course that is adequate to prepare a student for specialization. The time available in the curriculum for teaching is sufficient to cover only the bare fundamentals. Actual clinical experience cannot be provided. This experience can be acquired only over a long period, and the student has not the time, inclination or knowledge to carry on clinical cases.

The treatment of a single case is of little value, since each case is different and involves a host of individual characteristics. In my opinion, the best and most efficient method of conducting an orthodontic clinic in a dental school for undergraduates is by demonstration. In such a clinic, the different types of cases in various stages of treatment can be exhibited and explained to the student, and thus he can be given a better understanding of the problems involved in each case.

It is because of the incompetent character of the instruction, the poor organization of the course of study and the inadequate facilities provided in most schools that the development of orthodontia has not been so rapid as the progress in some other branches of dentistry. Another retarding influence has been the inability of investigators and clinical men to collaborate in the past, and the lack of cooperation of the same groups in more recent years. These statements are made with a knowledge of present accomplishments and without reflection on these achievements; but, unfortunately, the work has been confined chiefly to a comparatively small group, and little provision has been made in education to train men to engage in this branch of practice.

The requisites for qualification in the care and treatment of orthodontic cases and the long period involved in such treatment preclude the possibility of proficiency being attained in a short course of instruction and training. It is regrettable that more graduate schools covering a period in their courses commensurate with the known requirement in orthodon-

tic therapy have not been founded, to provide instruction both for those who wish to specialize and those who desire to include orthodontia in their training for general practice. In this respect, the graduate course organized at the Harvard Dental School is especially noteworthy. The course as outlined is designed to cover in a thorough and comprehensive manner the biologic as well as the clinical requirements of orthodontic practice. Dean Miner and his associates are to be commended for their effort to advance orthodontic educational facilities. It marks an important forward step and is an altruistic move to safeguard those in need of orthodontic service from the all too prevalent danger of incompetent training, advice and treatment.

A modern concept of orthodontia should include at least three phases of the subject: the biologic, the mechanical and the economic. These are so closely related that none can be excluded in the consideration of problems of orthodontic care and treatment.

In the biologic field, there are many factors which merit careful attention and study. The more consequential of the constituent considerations are development and growth, heredity and environment, etiology, diagnosis and prevention. The importance of a clear conception of the influence of each of these factors as related to orthodontic therapy cannot be overemphasized.

## DEVELOPMENT AND GROWTH

It must be realized at the outset, in the study of development and growth as it affects our work, that the tissues and structures with which we are immediately concerned are not separate entities, but integral parts of the organism as a whole. Only by accepting this observation as a fundamental truth can one hope to have anything akin to an intelligent understanding of our problems. The conscientious work of investigators in the field of biology has in recent years given us valuable information. The result of this constant effort to understand the mysterious plan of nature has changed the older conception of the problem and produced a more logical hypothesis from which to make deductions. It is now generally recognized that the somatic or body cells have a maximum potentiality as to both size and numbers and that the attainment of their full expression will depend on a continuous favorable synchronization of all growth factors. It is believed that there is a considerable range between the maximum that is possible in growth and the minimum that may be attained. It does not follow that all parts of an individual will develop in harmony with either extreme. The parts may vary in the degree of growth in different structures of the same individual. That is to say, each of the cells of a given structure has what may be termed a potential growth. The minimum is the stage of development which the cell must reach to be a living organism. The maximum potentiality, on the other hand, is dependent on a number of factors, similar to those already discussed. Axiomatically, one may perhaps say that the size, contour and general character of a structure is determined by the average of the development of its component cells. For example, if the average of the development of the cells composing the maxillae reaches a stage which we shall arbitrarily term norm, the average of the growth of the component cells of the mandible must be the same, or there will be a disparity between these related parts. The rule may be generally stated as follows: The degree of disparity between two related structures is proportional to the variation between the mean of their respective cell development. The foregoing propo-

sitions are true whether the consideration is the relationship between correlated structures or between a single structure and the organism as a whole. This law applies from inception to the full maturity of the individual.

In man, this process extends over a comparatively long period of years. It is evident that, during this time, there are many opportunities for the introduction and operation of conditions which tend to interfere with the fine balance necessary to perfect growth. When one realizes how intricate and complex are the processes of life, particularly the development and growth of the human organism, defects ought not to seem unusual. On the contrary, the many instances of disharmony between parts and the prevalence of morphologic deformities may well lead one to believe that disparities and defects are the rule rather than the exception.

When considering disparities in the jaws, teeth and contiguous parts, we must not overlook the fact that this condition may have its origin in some remote part of the body, and that associated structures, being similarly affected, may exercise a material influence on them.

Evidence accumulated thus far points to the fact that there is a comparatively wide variation in the growth of anatomic structures at certain ages in different individuals. The norm, founded upon a general average, varies considerably. Thus, the study of the individual normal becomes of paramount importance.

There are remissions in the periods of growth activity. These remissions do not necessarily occur in all parts of the body at the same time, so that what may appear to be an inharmony between structures at certain ages may, in the process of further growth, become corrected and properly correlated. It may happen that further correction and rectification may be hampered or entirely prevented by the introduction and activation of latent or extrinsic factors. The diagnosis and prognosis of a given case should be determined upon the basis of what is known about these things and not upon the assumption that a study of occlusal relationships is sufficient.

Present knowledge leads to the conclusion that even when two individuals are the same age, the range of normal variation in a given stage of development is so great that it is difficult to determine, at least before a certain period of growth, whether an abnormality actually exists. This great range in normal variation makes it equally hazardous to diagnose as abnormal the relationship of a specific structure to associated parts.

It is incorrect to assume that at any definite period during the progress of growth, the jaws and dental arches should conform to arbitrary specifications that can be applied in the adult. Equally erroneous is an assumption that at a given stage in the process of development, the jaws and dental arches should have, as regards size, proportion and position, a fixed definite relationship to other parts which will determine the norm at maturity. In short, none of the foregoing may be accurately determined by mathematical calculation.

The relationship between the dental arches, jaws and cranium has been the subject of much discussion and investigation. The position, development and proportion of these structures at certain periods of growth have not as yet been proved to be so related that definite rules may be formulated to determine this point. It has been suggested that by working from measurements of anatomic structures in which growth is constant, certain facts may be determined. Thus, it is contended that the relationship of the jaws to the cranium is such that com-

putations based upon measurements of the one will yield definite information regarding the other. Another theory is that from information founded upon measurements of the teeth, the size and shape of the mature dental arch can be predetermined.

In making deductions, each case must be treated as an entity. The necessary individual consideration, the limitless number of types and the inherent complexity of the phenomena of growth make any rule evolved difficult to apply. When one remembers that the bones and teeth develop from different tissues, that each jaw receives its stimulus from a different source and that numerous structures and activities must be synchronized and coordinated, the question of maintaining a balance of forces to insure proper results is a very complicated one. The foregoing considerations, further modified by intrinsic and extrinsic conditions which influence growth, leave little reason to wonder at the many instances of disparity, maldevelopment and malformation of the jaws and teeth, together with a complemental correlation of these structures and associated parts.

## HEREDITY AND ENVIRONMENT

The part taken by heredity, and its influence in producing malformation of the jaws and malocclusion of the teeth, has been a controversial question for many years. It has been claimed by the more enthusiastic supporters that every case is based on heredity, while the oppositionists have made as strong an assertion that heredity has little, if any, influence. In neither case has conclusive proof been available. There is a common ground upon which these extremists must meet. Up to the present time, there are no specific scientific data from which accurate deductions can be made concerning this moot question. From the knowledge we have of the numerous ramifications of hereditary influence in the development of the human organism, it seems needless to state that it may well be the predominant cause of many disharmonies. One need only study the subject superficially to be convinced that the inherent tendency of an organism to reproduce in its descendants certain peculiar characteristics of itself merits careful consideration. If the mendelian theory is accepted, and I believe it has been by most biologists, the mechanism of heredity has been clarified.

Professor Morgan claims that the chromosomes are the sole bearers of hereditary characteristics; therefore, the forty-eight chromosomes (twenty-four from the male sperm cell and twenty-four from the female egg) contained within the ovum after fertilization and reduction division will determine the exact type of individual which will be produced. Morgan's contention is that the die is cast at the moment the egg cell is fertilized and that there is no opportunity for the individual to change or modify the characters, traits or tendencies given by inheritance. According to his theory, all those characteristics which are the result of inheritance will be expressed and manifested in the adult, provided the individual lives and grows in a favorable environment and no unfavorable extrinsic conditions are permitted to interfere.

According to Mendel's theory, one-half of the inheritance is received from one parent and one-half from the other. The chromosomes are recognized as the sole bearers of the hereditary characters. The Mendel theory asserts that of the forty-eight chromosomes contained within each germ cell, twenty-four are lost by each cell at the time of the reduction division, and since selection is impossible, it cannot be foretold which characters, traits, etc., from either of the respective parents

will be transmitted to the progeny. One child may receive one set which are generally good, while another child may be unfortunate enough to receive a different set which are generally bad. In either case, each will develop an individual norm. This phenomenon no doubt accounts for the many variations observed in the morphologic structure and the physiologic processes in members of the same family.

There are countless combinations of characters or permutations in the mysterious formulas of the law of inheritance. It is said that there is a morphologic and physiologic difference in every germ cell, and that every oosperm and every individual which develops from it possesses its own peculiar characteristics. If conclusions are based upon this premise, it is obvious that structure and function would fall within a wide range of what we are pleased to call normal. It is difficult, under these circumstances, to predetermine, arbitrarily at least, to any degree of accuracy, the size, shape and form of an organ or structure or the exact relative position it should occupy in relation to other parts.

I must confess that I have never been convinced that a morphologic deformity is inherited, as is the color of the eye or hair, or any other specific character or trait which may come within the normal range of a particular individual. The theory of direct inheritance of specific types of malformation of the jaws and malocclusion of the teeth remains merely a theory. There is not enough evidence to remove it from this category. There is sufficient evidence to prove that the development of certain types of malocclusion is influenced materially by intrinsic hereditary conditions. One may submit as an example some types of Class II and Class III, Angle classification. In some cases, it happens that there is a disparity in the amount of tooth structure between the maxillary and mandibular teeth which causes a lack of harmony in occlusal relationship. It follows, therefore, that since most biologists maintain that the size and design of the teeth are among those features predetermined by heredity, this condition can be attributed to no other source.

The problems in the study of heredity and environment relating to the human organism are so varied and complex, and in a degree so speculative, that the question will probably always be, as it has been in the past, one of violent controversy. There are certain fundamental principles upon which we may all agree; namely, inheritance is absolutely necessary; life is not spontaneous and must be propagated and perpetuated through and by the living cell; and environment is a concomitant and necessary for its existence.

Variation in man, whether inherited or acquired, has always been, and still is, one of the important problems of evolution. It has produced a great many types and characters. There is no doubt now that a developing organism may be greatly affected by the environment in which it lives. Likewise, organisms may show a marked diversity, due to different inherited characters, although developing in the same environment. Dwarfism, giantism, color blindness, left-handedness, digital abnormality, deaf mutism, malformation of the eye and many other physical and mental conditions have been fairly well explained by investigators in the field of biology, but our problem, the problem of malocclusion of the teeth, is practically untouched scientifically. The field, while fertile, is relatively a virgin one.

## ETIOLOGY

A knowledge of the cause of malocclusion of the teeth is necessarily a condition

precedent to skilful treatment. A study of this subject is too often relegated to a place of minor importance by operators who view orthodontic therapy as comprising only mechanical measures. There is also a marked tendency in actual practice for the operator to consider only those factors which appear evident to the casual observer.

It must be remembered that the human denture and its associated parts require a long period in which to develop and, during this time, is subjected to all the influences of heredity and environment. If the normal is to be attained, these influences must be favorable, and all growth factors correlated. Should an unchangeable inherent force be present, or an unfavorable condition arise and be permitted to exist, the result will be an interference with the fine balance of the correlated growth factors, which will produce some form of abnormality. The extent of the deformity will depend in large measure on the seriousness of the interference with the normal physiologic processes of growth.

For the sake of discussion, I shall separate the causes of malocclusion into two classes: predisposing and exciting. This is rather an arbitrary grouping, since these causes are frequently so closely allied that differentiation is extremely difficult.

Dr. McCoy says,

> Predisposing causes of malocclusion include all conditions, influences, diseases, or agencies which interfere with the factors governing normal growth processes, and thereby render bodily parts susceptible to alterations of structure, function, and malgrowth. The direct or exciting causes are those conditions, influences, or events which specifically add the final impetus in directing the maldevelopment and malocclusion.

As has been suggested, the predisposing causes of malocclusion are far-reaching in their influence and are, in most cases, very difficult to detect. Each cause is almost without exception supplemented by another, and frequently complex combinations are formed, with damaging effect. The presence or operation of activating causes, only slightly evidenced in early years, may become more pronounced as development progresses. In fact, these causes, completely hidden behind the functional activity of the intricate, delicate and complicated mechanism of the human organism, may later become manifest in some form of incoordination.

Hereditary traits and influences are now considered to be the most important of the predisposing causes, although the effect of these influences has been a controversial question since malocclusion was first observed. There is, moreover, no present indication that the question will ever be definitely settled.

A few years ago, a certain group of orthodontists was led to believe that hereditary influences played no part in the development of malocclusion. Their teaching was taken so seriously that all accepted biologic opinion was discarded. Johnson says, "More than any one thing, the exclusion of the concept of heredity has been responsible for much of the inadequacy of orthodontic treatment." From my own observation and clinical experience over a number of years, I am convinced that the tendency of inherent influences to produce certain types of malocclusion and to contribute materially to bring about disharmonies in the development of the jaws and teeth cannot be effectively controverted. The jaws and teeth cannot be so separated from the organism as to be exempt from these influences. Prof. J. C. Brash, in his thesis on the "Etiology of Irregularities and Malocclusion of the Teeth," presents a rational view of this subject.

Congenital defects resulting from malnutrition and accidents are not in-

frequent contributory conditions. Deficiency diseases and many forms of constitutional disorders which affect normal cell metabolism, disturb functional activities and unbalance the normal action of the endocrine glands may also be contributing factors. A deficient or unbalanced diet is another important related consideration.

A host of exciting causes have been suggested as motivating factors in malocclusion. Many of these causes are supplemented by inherent influences. Accidents, abnormal muscular habits, sucking habits, the presence of adenoids, mouth breathing, the presence of enlarged faucial tonsils and an abnormal labial frenum, premature loss or long retention of deciduous teeth, loss of permanent teeth (particularly the first molars), the presence of transposed or supernumerary teeth, absence of teeth and improper dental restorations are a few of the common local causative conditions. Most of these do not occur singly, but in various combinations. It is a difficult task, in many cases, to determine the cause of malocclusion. When such cause is known, and it can be eliminated, the probability of successful treatment is greatly enhanced. So diversified are the opinions regarding the etiology, in the discussion of the subject one may find himself in a labyrinth from which there is little hope of escape.

## DIAGNOSIS

Diagnosis is the recognition of disease from its symptoms. It implies further that a decision has been reached by means of deduction from incidents pertinent to the case. An orthodontic diagnosis is a diagnosis made after a consideration of all conditions which may, in any way, affect a given instance of malocclusion. In making a diagnosis, all of the available knowledge on the subject should be utilized. Conclusions founded upon this utilization are the basis for the administration of the various therapeutic agencies.

In the last decade, much worth while research has been carried out in the field of orthodontic diagnosis. This work has not been fully appreciated nor utilized; particularly by those orthodontists stricken with a form of insanity which one may term "appliance mania."

The successful practice of medicine, surgery, dentistry and the allied special sciences is dependent in large measure on the intelligent and conscientious use of known methods for determining disease and other abnormal conditions. It is the only method upon which skilful treatment can be used. Real scientific progress in the fields of medicine, surgery and dentistry did not begin until after the problem of symptoms and disease was solved. True, it was a slow evolutionary progress, accomplished only after long and tedious investigation and much clinical experience, but the results have been well worth the effort.

There is an abundance of information which one may use advantageously in making a diagnosis, and one is remiss in his duty in proceeding solely upon the basis of occlusal classification. One need only review the case report of a hospitalized patient to appreciate the value of a careful diagnosis by the more exacting physician or surgeon.

When the dentists and orthodontists reach the point in practice where the care of orthodontic patients is founded upon a treatment based primarily upon a thorough diagnosis, such treatment will be more comprehensive and fewer failures will result.

## PREVENTION

The prevention of disease has become one of the more essential considerations in the field of medicine. The marvelous

contributions made in this field have been largely responsible for the eminent position attained by medical science. The major part of research and investigation in all branches of medicine is being directed toward this goal.

There is now a widespread sentiment among both the members of the dental profession and dental educators that the only solution of the economic problem of need and supply of dental service lies in the field of prevention. It is agreed that all of the service available in reparative and reconstruction work is entirely inadequate to meet the present condition of dental health needs. The same is true in orthodontia. It is possible to serve but a small part of those in need of orthodontic service by the use of corrective measures. The prevention of malocclusion, in whole or in part, has been wofully neglected in the past. It is a sad commentary on our science that so little thought and attention has been given this subject.

The application of preventive measures may be directed in various ways. First, the prevention of malocclusion may frequently be accomplished by a close study of development and growth; by establishing favorable environmental conditions; by remedying function disturbances; by maintaining glandular balance; by the early rectification of abnormal habits; by prescribing a correct diet; by instruction in proper mastication; by adequate prescribed and regulated muscular exercises; by close supervision of the deciduous and permanent dentition; by preserving the anatomic tooth form when reparative work is necessary; by the elimination of causative conditions; and, finally, by the maintenance of the normal forces of occlusion. Cases of incipient malocclusion may often be prevented from developing farther by the early recognition of a definite occlusal displacement or interference followed by the prompt application of simple corrective measures. Frequently, the malposition of but a single tooth will cause a serious case of malocclusion.

It is advisable, although not necessary in every case, to place space retainers when deciduous teeth have been prematurely lost, or when permanent teeth are lost and orthodontic measures are not instituted. The judicious extraction of deciduous teeth is frequently indicated. Particularly is this true when the teeth have been overretained, or the permanent teeth have not assumed a definite order of eruption. I have particular reference to those cases in which the bicuspids are making more rapid progress than the cuspids. The removal of the deciduous cuspids and first molars may often permit the permanent cuspids and first bicuspids to take their correct positions in the arch, and, at the same time, obviate the possibility of the space for the cuspids becoming partially closed.

The removal of the second deciduous molars is also important in many cases to enable the first permanent molars to assume a correct mesiodistal relationship. As a guide to the proper time for extraction, the combined mesiodistal diameter of the three deciduous teeth between the first permanent molars and the lateral incisors is quite sufficient in most cases to accommodate the teeth which are to succeed them, but the diameter of the individual teeth does not correspond.

Frequently, in deciduous dentures which present a correct mesiodistal relationship, the distal surfaces of the second molars are in a vertical plane or the mandibular molars project slightly distad. In either case, this condition is likely to cause the permanent molars to appear to be in an abnormal mesiodistal position. A method of avoiding this situation consists in grinding off a portion of

the distal surface of the second deciduous mandibular molar and placing a band with a distal convexity on the second deciduous maxillary molar. This will direct the permanent molars into a correct occlusal relationship.

Undoubtedly, the foregoing condition of the deciduous dentures is responsible for a great number of abnormal mesiodistal relationships, which may occur on one side, producing a unilateral disparity, or on both sides, giving rise to a bilateral abnormality.

The field of prevention is one in which the general practitioner can render a most valuable service. The early contact with children affords the opportunity to observe and correct conditions which tend to produce malocclusion. In cases of minor occlusal displacements such as linguoversion of central and lateral incisors, simple corrective measures may be applied which will prevent a more serious case of malocclusion.

### MECHANICAL

Mechanical therapy in orthodontia may be defined as the application of mechanical devices for the purpose of correcting occlusal disharmony and improving the function of the teeth. In order that this procedure may be successful, it is most essential that the operator have a sound knowledge of the biologic problems involved, as well as a clear conception of the fundamental principles relating to appliances. Although it is admitted that the use of an appliance is a necessary adjunct to the treatment of malocclusion, its relative importance in modern orthodontic practice has been overemphasized. I mean by this that too many practitioners are attacking the problem of treatment from the mechanical point of view alone. The biologic elements involved cannot be summarily dismissed, for the action of these influences cannot be controlled by a mechanical device.

The work of Oppenheim, Gottlieb, Orbán, Kronfeld, Marshall Johnson, Appleton and others has demonstrated the histophysiologic effect of pressure on the tissues during and subsequent to tooth movement. Their writings contain a warning against possible dire consequences of an indiscriminate application of force. Their investigations have given us a scientific explanation of bone resorption and repair under pressure as applied by orthodontic appliances. They have determined for us the amount of force which can be safely applied. Everyone interested in orthodontic therapy should study carefully the results of the work of these men.

### TREATMENT

In the final analysis, the ability to treat malocclusion intelligently and efficiently is the true test of a skilled orthodontist. Therein lies the secret of success or failure.

The objects of orthodontic care and treatment may be roughly classified and summarized as follows:

1. Prevention of malocclusion and malformation, in whole or in part.
2. Restoration of functional balance and activities.
3. Conservation and promotion of the health, not only of the immediate structures concerned, but, as far as possible, of the whole organism.
4. Synchronization of the factors of development and growth by remedying and removing interfering forces.
5. Correction of occlusal displacement and interference, and adjustment of malrelationship of the jaws and dental arches.
6. Improvement of the appearance of the individual by correlating and harmonizing all related parts.

7. Elimination of facial and structural deformities.

8. Instruction as to the importance and value of an efficient masticating apparatus.

9. Instruction in the hygienic care of the mouth and teeth.

10. Emphasizing to the patient the necessity of favorable environmental conditions.

It is obvious that before affixing mechanical appliances, all factors must be carefully considered, in order to determine whether the malocclusion which exists warrants such a procedure. The use of an appliance where it is not clearly indicated is inexcusable and may result in unnecessary and serious damage.

The inexperienced orthodontist and the average dentist are prone to place too much faith in the possibilities of an orthodontic appliance. There are, of course, certain types of appliances that are more efficient and have a broader application than other designs. Each type has its limitations regardless of the skill of the operator.

Many dentists are being attracted by the advertisements of mechanical laboratories, and are becoming the innocent victims of these unscrupulous and unethical venders of orthodontic appliances. The purveyors of these devices would have one believe that an appliance fashioned on a model is the predominant and only worthwhile consideration in the treatment of malocclusion. Any person who is inveigled into the practice of treating malocclusion by commercial laboratory instruction is ill advised indeed. It is an error to assume that a satisfactory result can be attained by following this method.

The age, accessibility, cooperation, nervous reaction and personal habits of the patient must be considered before beginning treatment. The degree of perversion, the extent of the changes necessary for correction, the proper method of procedure and the type of appliance indicated, and its limitation, are matters which the operator should recognize before orthodontic therapy is applied.

### EXTRACTION OF TEETH

The subject of the extraction of teeth in orthodontic therapy is once more attracting widespread attention. It is of vital importance, for errors in practice may result in irreparable damage.

In the old days, when most dentists knew little of the fundamentals of treatment, the first step in an attempt at correction was to remove one or more teeth. There were many papers and textbooks published giving definite rules for extraction of the various teeth. They covered all teeth from the central incisors to the second molars. These teachings resulted in much harm. The rules were misinterpreted by most dentists, and the extraction of teeth in practically all cases of malocclusion became a routine practice. The effects were not overcome until Dr. Angle emphasized the importance of occlusion, and published his occlusal classification. Some dentists today continue to hold fast to the old teachings.

Another practice proposed and promulgated persistently by a few men was the early extraction of the four first permanent molars. The reasoning behind this theory was that the removal of first molars would prevent a malocclusion in those cases in which it was thought that the teeth were likely to be too large for the jaws, and the further conjecture that the dental arches when fully developed would occupy a better axial position upon the body of the jaws. This practice became very prevalent at one time and in addition to the needless sacrifice of many teeth, irreparable damage was

inflicted. Fortunately, this vogue has run its course and has been entirely abandoned in modern procedure.

It is a well-known fact today that the relative size of the teeth and jaws of the adult cannot be determined at the age of 6 or 7. Even though they could be predetermined, the extraction of the four first permanent molars would not be indicated.

If any teeth can be said to be more valuable than others, they are the first permanent molars. The reasons are obvious. They are the first of the permanent teeth to develop and erupt and are the largest and most firmly attached. They determine the depth of the overbite and control to a great extent the mesiodistal relationship. Further, they are the most constant in taking a correct position in the arch, and owing to their size, design and location are the most valuable teeth in mastication. In addition, they serve as stabilizers during the transitional period of the dentures. The first permanent molars are of the utmost importance in orthodontic therapy. In over thirty years of practice, I have never seen a case in which, in my judgment, the extraction of four first permanent molars was indicated, either for the prevention or in the treatment of malocclusion.

There are some cases of malocclusion in which the extraction of teeth is advisable, but each case must be decided on its own merits. There is no hard and fast rule which can be applied, because the conditions encountered are too variable. An extraction should never be made until after a thorough and painstaking diagnosis, in which all the possible factors in the case have been carefully considered.

Instances of mutilation, when the cheek teeth have migrated forward and are usurping the space of other teeth, and occasionally in Class II and Class III cases, Angle classification, extraction may be the remedy. The removal of the second molars, moreover, may be advisable in certain cases if the arches are unduly crowded, the interdigitation of the cusps is incomplete and the third molars are well formed and occupy favorable positions with respect to eruption. It is not always possible to attain the ideal in occlusion or perhaps, more properly stated, the individual normal; therefore, judicious extraction is sometimes advisable. When indicated, it will facilitate the work and bring about a satisfactory result in a shorter time. I realize the danger in making this statement because of its misinterpretation by the inexperienced who attempt to treat malocclusion, but careful study should in time enable a man of average intelligence to determine when extraction will better accomplish his purpose.

## ECONOMICS

Perhaps the most simple definition of economics characterizes it as the science which deals with the conditions and laws determining the relationship of supply, distribution and demand.

Economics is no longer an exact science dealing merely with distribution of wealth. Its modern concept has so enlarged that it encompasses almost every phase of social and commercial life. Thus, the subject "Dental Economics" is not fanciful.

The present economic upheaval has materially affected every phase of dental education and practice. Dental educators have before them constantly the problem of changing the courses of instruction to meet the ever-increasing demand of dental practice or rather the enlarged dental health needs of the public. To train the undergraduate to meet this condition, the standards of dental educa-

tion have been uniformly raised both in the entrance requirements and in the professional course. These added requirements have steadily increased the expense of education, affecting student and school alike. As a result, the cost of dental service has reached a point where only a small percentage of the population can afford it.

Dentistry is accepted as a full division of public health, and is a part of practically all public health programs. The people have been educated to appreciate the importance of dental disease in its relation to general health, and thus realize the need for dental service. Under present economic conditions and methods of practice, this service is beyond the reach of most people. Herein lies a danger which may necessitate radical changes and adjustments in dental education and practice.

State dentistry may be approaching more rapidly than we realize. It may be in the form of taxation or compulsory or voluntary health insurance or a combination of all three. The result will be practically the same, and will necessitate a revamping of present methods of education and practice. Any student of political science will tell you that, once decided upon, the transition from private control to governmental paternalship is very rapid. In my opinion, the first attack in the solution of this problem is a general revision of fees, at the same time maintaining the high quality of service.

Orthodontists cannot escape this situation. Rigid economics will be necessary both in overhead expenses and in the utilization of the operator's time. There should be a more even distribution of work over the day so that a larger number of patients can be served. The average fee could then be reduced, since the overhead expense is an almost constant factor in the equation.

Owing to decreased earnings in the last two or three years, many general practitioners have endeavored to increase their incomes by treating malocclusion. There can be no objection raised to the plan, provided the practitioner has been adequately trained in orthodontic procedures. Otherwise, nothing but failures may be expected.

The only solution of an economic problem involving several million children in need of orthodontic care lies in the general practitioner's furnishing the major part of this service, but, before doing so, he must become proficient in the work. When the dentists finally recognize the fact that mechanical devices are only the means to an end, and that they can be successfully operated only by those grounded in the fundamental principles of orthodontia, progress in this science will receive a new impetus. Any dentist desiring to practice orthodontia must be willing to give sufficient time and effort to secure a proper and adequate training. Otherwise, he will but flounder in the dark and be unable to furnish a competent or satisfactory service.

# A SPLINT FOR FRACTURES OF THE MAXILLARY BONES

By WALTER M. MORGAN, D.D.S., Nashville, Tenn.

AFTER treating fracture of the bones of the face for the past fifteen years, I became dissatisfied with the splints which were used in the treatment of fracture of the maxillary bones. In my search of the literature, I was unable to find a splint which answered my requirements, and while the splint which I present is the result of my efforts, analyzed it will be found to be a composite of principles presented by former writers.

The history of treatment of fracture of the jaw bones and the type of appliances used in treatment is most interesting. Many ideas have been advanced by various early writers, and a few, having proved fundamental, are in use today. Hippocrates (about 460 B.C.)[1] described cases of fracture of these bones and advocated methods for treatment. He mentioned the use of silk and linen ligatures and also gold wire with which to bind together the fractured bones. Aulus Cornelius Celsus (about 30 B.C. to 50 A.D.) also described ligatures for this purpose and particularly emphasized the use of horse hair. It was Celsus who first advocated the use of a sling for the chin, a method of treatment which has been erroneously attributed to Galinus (131 A.D.). While no mention seems to have been made by Celsus of the necessity of maintaining the teeth of the opposing jaws in their occlusal relation, this procedure was followed by Celsus with his sling.

In the year 1180 at Salernum was compiled the textbook of surgery called Maestro Ruggero from Parma, which, with the notes added in the thirteenth and fourteenth centuries, constitutes the greatest book of surgery of the so-called "Scholastic Medicine."[2] Ruggero, from Parma, in fact, wants the occlusion of the teeth reestablished. He writes: "In the fractures of the mandibula, the lower teeth are not in contact with the upper ones and the patient cannot masticate. Then the patient must be taken by the lower maxilla and this must be moved here and there until the lower teeth will touch the upper ones."[3]

As far as we can find, this seems to be the first actual mention of the importance of maintaining the normal occlusal relation of the teeth in the treatment of fractures of the maxillary bones.

In the year 1275, Wilhelm from Piacenza or from Saliceto wrote in Verona the Praxeos Totius Medicinae, in the second part of which (Surgery) he speaks of the fractures of the mandible, modifying the primitisti method of ligature of the teeth; in fact, he bound the teeth proximal to the fracture not only between themselves, but also to the corresponding teeth of the maxilla. This method of wiring has also, at our time, clever defenders.[3]

Here we have not only mention of the normal occlusal relation of the teeth, but also, as far as we can find, the first mention of intermaxillary immobilization.

As we have been able to find, the use of splints in the treatment of these cases was first mentioned by Chopart and Desaut,

1. Guerini, Vincenzo: History of Dentistry, Philadelphia: Lea and Febiger, 1909.

2. Footnote 1, page 389.

3. Footnote 1, page 390. Brophy, T. W.: Oral Surgery, Philadelphia: P. Blakiston's Son & Co., 1915.

about 1750. Among the first splints to be used were watch springs placed on the lingual side of the teeth and held in place by ligatures passing around the teeth. Another primitive splint consisted of a grooved piece of metal placed over the teeth and extending to both sides of the line of fracture.

One of the earliest splints to come into general use was the Hammond splint,[4] which consisted of a heavy piece of wire accurately conformed to the variations of the buccal and lingual surfaces of the teeth (Fig. 1) with interdental wires to hold the splint in place. By this means, immobilization of the parts was accomplished.

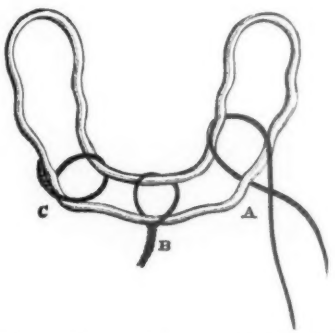


Fig. 1.—Hammond splint with buccal and lingual wires adapted to the contour of arch and soldered together posteriorly to molars, a continuous wire thus resulting.

While in 1275 Wilhelm of Piacenza mentioned intermaxillary wiring, the first description of a definite method of immobilization of the mandible in contact with the maxilla was found in a case reported by E. J. Fountain.[5] The case was most unusual and presented many difficulties. To reduce the fracture was simple, but to maintain reduction was difficult. The deformity caused by the fracture constantly recurred in spite of the application of all methods of fixation as advocated by former writers. Dr. Fountain, in desperation, was on the verge of declaring the case hopeless when a novel method occurred to him. He says:

In the spring of 1865, W. G——, aged 42, fell from a height about ten feet, striking his chin upon a hard piece of timber. The result was a fracture of the lower jaw through the body on either side, and also through the neck of the condyle on the left. . . . A method then occurred to me which I at once announced as a sure way

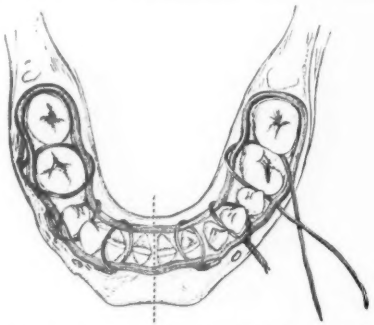

Fig. 2.—Hammond splint held in place by interdental ligatures.

and the only way by which deformity might be prevented, and the parts made to unite permanently in their true position. The jaw was displaced backwards and laterally towards the injured side. By firm and steady traction it could be brought out in place, and now the question was how to keep it there. The anterior portion of the superior maxillary, or its prolongation by the teeth presented this fixed point, and by drilling holes in one or more of the upper and lower teeth in front, and firmly wiring them together in their normal position, the lower jaw must of necessity be prevented from falling backwards or to one side.

4. Marshall, J. S.: Manual of Injuries and Surgical Diseases of Face, Mouth and Jaws, Philadelphia, 1902.

5. Fountain, E. J.: Rare Form of Fracture of Lower-Jaw; Involving Neck and Body, Treated by Novel Method, New York J. Med., 8:140-145, 1860.

Wrapping wire around the teeth could not be depended upon. The holes drilled for this purpose I thought could be easily filled by a dentist and thus preserved; and even though much injured or destroyed, how trifling this loss compared with a lasting deformity of the whole jaw—unsightly in appearance, and serious in its effects upon the voice and mastication.[6]

The methods as advanced up to this time, while probably giving very satisfactory results in certain individual cases, presented no very definite ideas relative to the successful treatment of this type of injury. There was, more or less, a feeling that one was groping in the dark, and those who were so unfortunate as to have these cases fall into their hands merely did the best they could, and the case terminated not infrequently with a deformity. Not until 1861 was an appliance presented which was recognized as answering the requirements in the treatment of this type of case. This appliance was presented by Thomas B. Gunning,[7] of New York City. Gilmer,[8] in one of his lectures, states: "Various appliances, some very simple, others exceedingly complicated, were resorted to for the purpose of retaining the fragments in position; but upon the introduction of vulcanite for this purpose, by the late Dr. T. B. Gunning, the older forms passed out of use."

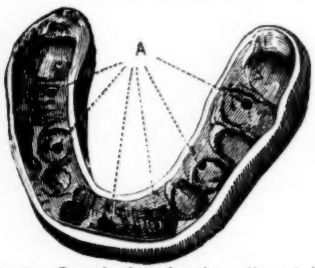


Fig. 3.—Gunning's vulcanite splint. *A*, holes through vulcanite to facilitate cleaning without removing splint.

This splint of Gunning's to which Gilmer refers was made of vulcanite and was a splint for the mandible. (Fig. 3.) To quote Gunning:[7] "On February 12, 1861, I applied a 'hard vulcanized rubber splint' to the fractured jaw of a seaman in the United States Naval Hospital, and from the vulcanite splints used by me since that time I have selected three which show all that is essential to hold any fractured lower jaw in place."

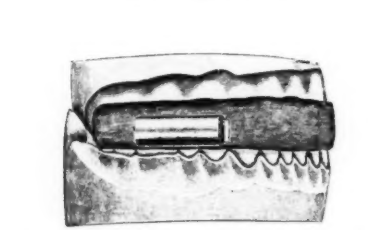

Fig. 4.—Splint showing tubes of Marshall into which wings are inserted.

This splint is adapted to the teeth in such a manner that it covers the entire crowns of the lower teeth and also covers the gum tissue slightly. The indentations of the upper teeth were made on the occlusal surface. Occlusal openings were made to allow for cleansing without necessitating the removal of the splint. This splint was often used without any attempt to fasten it to the teeth, while at times it was necessary to use ligatures or screws carried through the splint into the interdental spaces to hold it in place. Gunning's invention of the vulcanite splint was a distinct contribution and is

6. Footnote 5, page 141-142.

7. Gunning, T. B.: Treatment of Fracture of Lower Jaw by Interdental Splints, New York M. J., 3:433-448, 1866.

8. Gilmer, T. L.: Lecture on Fracture of Maxilla at Northwestern University Dental School, Chicago, 1901.

in use today either in vulcanite or, swaged or cast, in metal.

After Gunning, the next author of any importance was Norman W. Kingsley,[9] to whom has been credited the addition of wings to the Gunning vulcanite splint, this type of splint hence being called the Kingsley splint. As far as I have been able to analyze the literature, it seems that the priority in publication really belongs to Gunning, as the earliest references I have been able to find giving the dates of the presentation of a winged splint are the following. In 1863, Gunning says[10]: "On June 17th I applied a splint like Fig. 1, without screws, but

Fig. 5.—Kingsley's interdental splint.

held down by a strip of silk passing under the chin, and, supported by wings which projected from the splint, came out over the lower lip, and continued along the sides of the jaw like the wings of Fig. 4."

This splint was presented to the New York Academy of Medicine in October, 1863, and fully described in a paper read before the Academy, June 1, 1864.[11] The adaptation of the silk to these wings was the same as is shown in the splint marked Kingsley's in Figure 5. To quote from Kingsley[12]: "For more than fifteen years I have made and used interdental splints."

While this quotation makes no definite statement as to the style of splint used, if we should take Kingsley's statement to mean that he used a winged vulcanite splint fifteen years prior to the publication of this book, the date of his splint would be 1864; while Gunning's application of his first vulcanite splint with wings was on June 17, 1863. Kingsley's splint was a splint for the lower jaw, just as Gunning's original splint was. It is thus possible that Kingsley really used

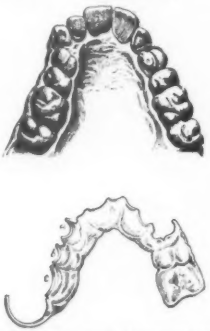

Fig. 6.—Gilmer's arch bar method for treatment of fractures of mandible.

the splint first, but certainly Gunning gave us the first description and used it as early as, if not before, Kingsley.

To vulcanize these wing splints, there was required a very large flask, which was not in the equipment of every dentist, as was the small flask in which every dentist vulcanized his dentures. This fact lead Marshall[4] to devise sockets into which the arms would accurately fit and which had attachments to be embedded firmly in the vulcanite. The wing splint was used in the treatment of fractures of both the upper and the lower jaws. The

9. Kingsley, N. W.: Oral Deformities, 1879.

10. Gunning, T. B.: Treatment of Fracture of Lower Jaw by Interdental Splints, New York M. J., 4:13, 1866-1867.

11. Footnote 7, page 14.

12. Footnote 9, page 398.

first splint for specific application to fractures of the superior maxillary bones was devised by Salter.[13] (Fig. 6.) This splint was made of gold.

These splints have had in common the fact that when the mouth was closed, the upper and lower teeth were separated by the occlusal portion of the splint; which caused marked discomfort, as well as a probable slight deformity in the adaptation of the teeth to their normal occlusal relation.

Intermaxillary wiring had been used prior to the presentation of Gunning's splint; occlusal relation had been mentioned, and various writers had spoken of the necessity of assembling the models of the jaws so that the teeth should be in exact occlusal relation; but it was Thomas L. Gilmer[8] who, more definitely than any former writer, emphasized the danger of destroying the occlusion of the teeth and who also utilized methods whereby the normal occlusion of the teeth could be maintained and kept constantly in view. While Dr. Gilmer was appreciative of the ideas offered him by his contemporaries and earlier writers, he readily grasped the pitfalls into which one might fall in using these appliances and set about to obviate these difficulties. As a result, he made contributions in this field which far excelled any earlier ones as well as most of those subsequently proposed.

In 1881, Dr. Gilmer[14] made this statement concerning the Gunning splint: "With this splint as generally used it is impossible to know whether all the teeth are entirely up in their sockets in the appliance, as the teeth of both jaws are fully covered; while the great bulk of material necessary inside the mouth, together with the filthiness of such an appliance, speaks strongly against it." This statement is just as logical today as when written.

Likewise, in 1881, Dr. Gilmer devised his posterior band splint which had the advantage of allowing the articulation of the teeth to be seen at all times. In 1887, he described for the first time a method of simple intermaxillary wiring. Dr. Gilmer likewise gave us the arch bar method of wiring, such as is shown in Figure 7; a most flexible and satisfactory

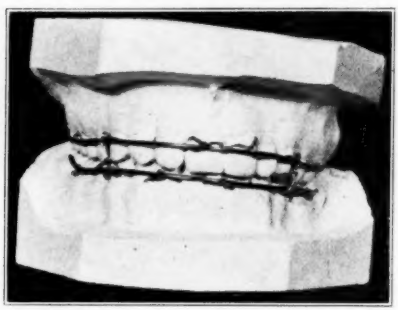

Fig. 7.—Gilmer's arch bar method for treatment of fractures of mandible.

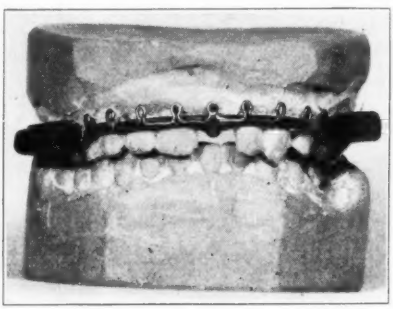

Fig. 8.—Splint as presented, showing articulated models without interfering with occlusion; arch bar of Gilmer; tubes of Marshall.

13. Salter, James: Fracture of Superior Maxilla and Its Treatment, Lancet, 1: 593-594, 1860.

14. Gilmer, T. L.: Fractures of Inferior Maxilla, J. Ohio D. Soc., 1881, p. 25.

method of wiring a fractured mandible.[15]

The contributions which dental surgeons have made to this special field of surgery have justified the long accepted statement that the dental surgeon can be of great assistance in the treatment of these injuries because of his knowledge of the occlusion of the teeth and his ability to interpret what was the normal in the case of a mandible or maxillae distorted through injury.

The World War afforded a great opportunity for the development of the treatment of face wounds, and a large number of cases of this type were treated. Various splints were used during the

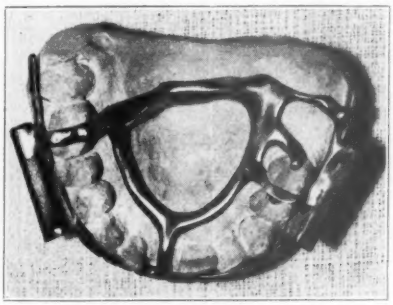

Fig. 9.—Cast of upper arch showing splint held in place by interdental wires, also occlusal rests and palatal bars.

War, all of which were similar to those described above or different only in minor details, with the exception of planes working one against the other to prevent the luxation to one side in the case of those extensive injuries wherein a large portion of the mandible had been destroyed.

To one called on to treat these face wounds while in the army, and closely following these cases since returning to private practice, it was obvious that some improvement should be made in the treatment of fractures of the maxillary bones. The splint which I present in Figures 8 and 9, with its practical application in Figures 10, 11 and 12, is, as far as I am able to ascertain, the first of its kind. Nevertheless, there is nothing new about the splint. It merely illustrates the assembling into one unit of several different principles, all of which have been advanced by former writers.

To be certain that this splint has not been used (I had searched in the literature and could find no reference), in April, 1931, it was sent to Thomas L. Gilmer, Chicago. I quote from a letter received from him dated April 14, 1931:

Fig. 10.—Splint inserted showing normal occlusal relation, and small stainless wires fixing splint to head cap.

Your letter received, also today your casts and splint for jaw fractures. It is certainly a new method and with one exception I cannot offer a single criticism, and that is really not a criticism of the splint, but few dentists I fear will be sufficiently

15. Gilmer, T. L.: Lectures on Oral Surgery at Northwestern University Dental School, Chicago, 1907.

skilful to make it. No one, as far as I know, has made such a splint and I think you may present it without any fear of infringement.

The construction of this splint embodies the principles which have been in use over a long period of time. The best impressions possible to obtain are taken, and casts are then poured in artificial stone and the impression separated therefrom. The teeth are then articulated in normal occlusion. This procedure necessitates the cutting of the models in the

Fig. 11.—Palatal view of splint.

line of fracture when displacement (at the time of injury) has produced malocclusion. The casts, held in this position, that is, with the teeth in normal occlusal relation, are mounted on an articulator. The labial arch bar, such as was used by Gilmer (Fig. 7), is adjusted to the labial and buccal surfaces of the upper teeth. This is held in place by interdental wires. (Fig. 2.) The tubes (Fig. 4) are adjusted to the arch bar in the bicuspid and first molar region and securely waxed in place.

The next point for consideration is to determine the best location for the palatal bars and the occlusal rests. These spaces are either interocclusal spaces or are present owing to the previous loss of teeth from the lower arch. In the location of these, consideration must be given to the balance of the splint when placed in the mouth. These rests must be sufficient in number and size to give a fixed position to the splint when in place. There must be sufficient attachments between the

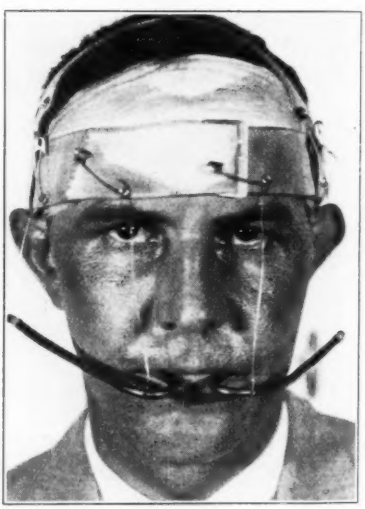

Fig. 12.—Head cap, stainless steel wires and wings. There is little inconvenience to the patient in closing the mouth.

palatal bar section and the labial bar to give rigidity to the arch bar.

After the palatal bars have been outlined, adhesive plaster, sufficient in thickness to leave the space desired between the soft tissues and the finished splint, is placed on the casts. A wax form is now made for the palatal bar and rests. This is invested and cast in gold or any rigid alloy. After polishing and finishing, this casting is returned to the model and the

points of attachment to the arch bar are united with wax. The interdental wires are cut and the entire splint removed from the model. This is invested in fireproof plaster and the tubes, arch bar and palatal bars are united by soldering. The splint is polished and finished with the thought constantly in mind that there must, if possible, be no points for the lodgment of food, and convexity should be given the surfaces of the palatal bars where possible.

As will be seen, this splint utilizes the arch bar of Gilmer (Fig. 7), which is a modification of the Hammond splint (Fig. 1). To this is soldered the tubes of Marshall (Fig. 4), and into these tubes are inserted the wings of Gunning (or Kingsley). (Fig. 5.) The remaining portion of the splint consists of palatal bars and occlusal rests (Fig. 9), such as have long been used by the dental profession in restorative dentistry. These palatal bars and rests serve a dual purpose: (1) extreme rigidity is given the splint, and (2) the splint will have a fixed position when inserted in the mouth. This splint (Fig. 9), having been placed within the mouth, is held in position by interdental wires in a manner similar to that described by Hammond. (Fig. 2.) This splint (Fig. 9) has the advantage of cleanliness, no great bulk of material, constant fixation, and constant immobilization of the fractured bones. Also, the occlusion is always visible. The splint may be adjusted to any type of head cap. After the patient has worn it for a few days, he can aid greatly in adjustment of the splint, as he becomes daily more sensitive to any changes from the normal occlusal relation of his teeth.

I have used small gaged stainless steel wire for connecting the wings to the head cap. (Figs. 10, 11 and 12.) This has a double advantage: (1) it is nonelastic and (2), after the fracture is reduced, if it is necessary to carry the wire across the line of vision, the patient will very easily become accustomed to the presence of the very fine wire, and it will not obstruct his vision.

## SUMMARY

In the construction of this splint, impressions of both upper and lower jaws are necessary and the cast of the fractured maxillary bones usually has to be cut in order to restore the teeth of the casts to normal occlusal relation. When the casts are adjusted to normal occlusion, it will be found that there will be interocclusal spaces through which rests and connections to the arch bar can be carried even though there is a full complement of teeth. There are very few mouths of which this statement will not prove true. Rigidity of the splint without interference with the contact of the upper and lower teeth is thus obtained. The palatal bars must be constructed so that contact with the soft tissues is avoided. Sufficient space should be maintained between the palatal bars and the mucous membrane so that even if the teeth undergo a definite settling in their sockets, the palatal bars will not be in contact with mucous membranes. It is obvious that should the palatal bars be in contact with the tissues and a settling of the teeth take place, there will be pressure necrosis of the mucous membrane. Also, the palatal surface of these palatal bars should be slightly convex in order to facilitate cleansing.

## REPORT OF CASES

CASE 1.—*History.*—A man, aged 25, and well developed, gave a past history of no importance. The cause of his injury was a delayed explosion of dynamite. He was admitted to hospital, October 9; discharged, November 4.

*Physical Examination.*—The entire face was swollen, but more so over the left eye.

The left eyelid was lacerated and the eye blood-shot. The vision was good. The right pupil was slightly dilated. The lower lip was cut at the median line. As several teeth were broken, the patient was unable to close the teeth in the normal occlusal relation. The upper palatal bones were movable. The patient was irrational at times. There was no vomiting and no headache. The blood pressure was: systolic, 128; diastolic, 60. The pulse was 80, the respiration normal. The temperature was only slightly elevated.

*Diagnosis.*—Bilateral fracture of the maxilla over the apices of the teeth was diagnosed, with fracture of the mandible at a left angle posterior to the third molar. There was a possibility of brain injury.

*Treatment.*—Owing to the possibility of brain injury, it was deemed unwise to attempt reduction of the fracture on admission. October 23, under gas anesthesia, reduction was attempted and a splint applied. October 28, there was swelling in the region of the lower left third molar. This subsided under treatment and the patient was permitted to leave the hospital November 4, with instructions to return to the office for adjustment of the splint and for observation.

December 1, the patient was readmitted to hospital for treatment of an abscess of the lower third molar region. December 6, under gas anesthesia, the third molar was removed.

*Comment.*—Owing to the severity of the injury, with possible complications which occasioned a delay in the reduction of the fracture, it was never possible to get all of the teeth in occlusion, and as the upper right second molar and the upper left second molar were broken down, it was deemed best to remove these in an effort to correct the open bite. These teeth were removed under gas anesthesia, December 19, and, December 21, the patient was discharged from the hospital with markedly improved occlusion.

During the first admission to the hospital, the temperature (axillary) was never above 100.6, and on the second stay it was never over 100.6 by mouth, with a pulse of 110 and respiration 21.

This was the second case in which the splint as presented in this paper was used, and while the results could have been improved, we feel that, when due consideration is given the severity of the injury, with the marked displacement and the delay occasioned by the condition of the patient, when we deemed it unwise to manipulate in an attempted reduction, the results as obtained were very satisfactory.

CASE 2.—*History.*—A man, aged 29, white, gave an unimportant past history. The cause of his injury was a motorcycle and automobile collision. He was admitted to hospital, May 31, 1931; discharged, June 6.

*Physical Examination.*—An anterior tooth was broken. The condition of the mouth in general was good. There was a scalp laceration, slight concussion and a bilateral fracture of the maxilla. The pulse was of good quality and respiration good. Vision was good and the pupils were equal and normal. The hearing was good. Nasal obstruction had resulted from the presence of blood and mucus. The left side of the neck was swollen. Examination of the chest and heart was negative. The blood pressure was: systolic, 100; diastolic, 80.

*Diagnosis.*—Bilateral fracture of the maxilla was diagnosed.

*Treatment.*—May 31, roentgen-ray examination revealed no fracture of the skull and a suggestion of fracture in the region of the frontal sinus and nose. June 8, the splint was applied. Adjustments were made daily until June 12 and every three to five days thereafter. July 13, the splint was removed. Union was obtained with good occlusion of the teeth. (Figs. 10, 11 and 12.)

CASE 3.—*History.*—A man, aged 33, white, well developed, gave an unimportant past history. The cause of injury was an automobile accident, the car hitting a telephone pole. The date of accident was Nov. 3, 1929. Discharge from hospital was November 8. The patient was brought to Nashville on the fifth day after the acci-

dent and it was unnecessary to admit him to hospital.

*Physical Examination.*—The accident occurred in the middle of the night. Within twelve hours, the patient's eyes were closed by swelling and there was hemorrhage into the right eye. Both nostrils were occluded with blood and mucus. The neck was markedly swollen. Owing to the fact that the history was not sent to Nashville with the patient, and he was not examined by me until the fifth day, there is no record of the blood pressure, pulse and respiration at the time of injury.

*Diagnosis.*—Bilateral fracture of the maxillary bones was diagnosed, the fracture line extending over the apices of the roots of the teeth and compounding into the sinuses. The fracture line also extended up through the right orbit at the superior external angle. The entire maxillary process was forced downward and backward until the upper anterior teeth were occluded distad from the lower anterior teeth, the patient having thus a prognathous jaw, the segment being impacted.

*Treatment.*—On the fifth day after the accident, the patient was brought to me and impressions were taken for construction of an appliance, which was inserted the following day, November 9, under gas anesthesia. At this time, the impaction and displacement were reduced and immobilization was accomplished.

The patient was seen, November 11 and November 14, for adjustment of the splint, and returned to his home town, where he was seen at intervals by his physician for the necessary adjustments. November 26, he returned for examination, and at this time the occlusion was most satisfactory. The patient was not seen again until January 20, which was after the splint had been removed by his physician. Fixation was good and occlusion most satisfactory.

Case 4.—*History.*—A man, aged 28, white, gave an unimportant past history. The cause of injury was the falling of an elevator 12 to 14 feet. The patient was unconscious thirty minutes. He was admitted to hospital, Feb. 16, 1933; discharged, March 28.

*Physical Examination.*—The eyes were equal. The left eye was swollen and lacerated. The left nostril was occluded by serum and blood. The neck and chest were negative. The upper lip was cut. Fragments of the superior maxillary process were displaced posteriorly and divided at the palatal sutures. The blood pressure was: systolic, 136; diastolic, 74. The pulse was 80; respiration, 16.

*Diagnosis.*—Fracture of the leg and bilateral fracture of the maxillary processes, with marked displacement and division at median line, was diagnosed.

*Treatment.*—February 24, the splint was applied. Reduction of the fracture was made, with application of the plaster cap for anterior traction.

The temperature was never over 99.8, the pulse never over 100 and respiration never over 20.

The patient was discharged, March 28, to return to the office for treatment and adjustment of the splint. April 14, when the splint was removed, there was firm union.

## COMMENT

I have used this splint in only four cases, and because of the small number of cases, I feel some hesitancy in presenting it. The enthusiasm of those who have seen the splint, in addition to the satisfactory results that I have been able to obtain with its use, is the inspiration for this paper, and I present it with the hope that it may help others out of extreme difficulties, just as it has me.

With the causes of injury to the bones of the face being such as to result in even more extensive injury than we have formerly seen, this type of appliance offers advantages. It has no great bulk; it can be kept clean, and it can be adapted to the most difficult type of injury where there are only a few teeth present. With the complication of a fracture of the mandible, in conjunction with a fracture of the maxillae, it can be used with suc-

cess. The occlusion is in constant view.

It is not unusual to find the fracture lines compounded into the mouth and, with this splint, the mouth can be easily cleaned and the progress of the case observed daily without removal of the splint. I believe it to be as simple of construction as any modern splint, having the advantages of most and as few disadvantages as any.

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# REPORT OF THE RESEARCH COMMISSION, AMERICAN DENTAL ASSOCIATION

*To the Officers, Board of Trustees, and House of Delegates of the American Dental Association:*

At the annual meeting of the American Dental Association held in Chicago, Ill., Aug. 7-12, 1933, an appropriation in amount of $11,500 was given to the Research Commission to cover grants and administrative expenses for the fiscal year beginning July 1, 1933, and ending June 30, 1934.

The Research Commission allocated this fund as follows:

| | |
|---|---|
| American Dental Association Research Fellowship at the National Bureau of Standards | $ 8,800 |
| University of Louisville | 750 |
| New York Institute of Clinical Oral Pathology, Inc. | 750 |
| Research in Rickets, Johns Hopkins University and Harriet Lane Home | 700 |
| Executive Board | 250 |
| Secretary's Office | 250 |
| | $11,500 |

GRANT NO. 1 — AMERICAN DENTAL ASSOCIATION RESEARCH FELLOWSHIP, NATIONAL BUREAU OF STANDARDS, WASHINGTON, D. C.

The grant to the Research Fellowship at Washington is a cooperative project between the National Bureau of Standards, Department of Commerce, and the American Dental Association. Two years ago, the Federal Government appropriated, and participated to the amount of, $10,000 in this project. Owing to drastic governmental economies, the Federal appropriation last year was reduced to $5,000. This year, the Federal appropriation was increased to $6,500, but owing to necessary Federal economies, only $4,000 of this amount could be expended.

For the next fiscal year, the Government has appropriated $4,200, all of which will be used in this cooperative project.

The Research Commission of the American Dental Association appropriated this fiscal year $8,800 for this cooperative study. From this sum, the salaries of two full-time research associates are paid. G. C. Paffenbarger, D.D.S., and W. T. Sweeney, B.S., are employed full time on this project. Their salaries total $7,200, which leaves only $1,600 for supplies, equipment, printing and miscellaneous expenses.

The government personnel giving part of their time to this work are William Souder, Ph.D., Aaron Isaacs, chemist, and such other persons as are on duty in the Bureau of Standards as their services and advice are needed. In addition, the

Director of the Bureau of Standards, Dr. Lyman J. Briggs, is giving this work his active personal attention.

The Federal Government furnishes adequate rooms, clerical personnel and considerable equipment.

During the past year, approximately 100 persons have visited the laboratory where this cooperative work is carried on. Many of the visitors were from foreign countries, including Japan, Germany, Switzerland, England, Scotland and Sweden. The Japanese imperial government has established a similar research department for dental materials in their national institute of health. One dentist and three physicists have been assigned to this work.

During this fiscal year, reports from the laboratory at the Bureau of Standards were read before the Chicago Centennial Dental Congress, the New York Society of Orthodontists, the Ohio State Dental Society, the Chicago Dental Society and the Five-States Post-Graduate Clinic in Washington, D. C.

*Specifications and Certification.*—The revised amalgam specification and a list of all dental materials which were certified to the Research Commission by their respective manufacturers as complying with the seven A.D.A. specifications were published in the April, 1934, issue of THE JOURNAL. This list of 120 certified products is growing at a rapid pace, since so many concerns have either established a testing laboratory of their own or have availed themselves of the facilities of consulting laboratories to regularly test their products. Also, more dentists seem to be demanding materials which comply with the specifications; and as additional specifications are formulated for materials not now covered, the list will become considerably longer. The lengthening of this certified list creates several problems which the Research Commission should consider.

If the certification plan is to be effective, the guaranteed products should be checked at definite intervals for compliance with the requirements of the specifications. The present personnel cannot do this check-testing of materials for which specifications are now operating unless all new projects such as investigations of silicate cements, denture materials, gold alloy substitutes, etc., are suspended. If all of the present certified materials were purchased in sufficient amounts for compliance testing, the expense for this item alone would be well

COMPARATIVE FINANCIAL FINDINGS

| | Grant for 1933-1934 | Disbursed June 30, 1934 | Unexpended Balance to June 30, 1934 |
|---|---|---|---|
| 1. American Dental Ass'n Research Fellowship at the National Bureau of Standards | $ 8,800.00 | $ 8,283.15 | $ 516 85 |
| 2. University of Louisville | 750.00 | 750.00 | ..... |
| 3. New York Institute of Clinical Oral Pathology, Inc. | 750.00 | 375.00 | 375.00 |
| 4. Research in Rickets, Johns Hopkins University and Harriet Lane Home | 700.00 | 350.00 | 350.00 |
| 5. Executive Board | 250.00 | 139.12 | 110.88 |
| 6. Secretary's Office | 250.00 | 245.65 | 4.35 |
| Total | $11,500.00 | $10,142.92 | $1,357.08 |

Respectfully submitted,

THOMAS B. HARTZELL, *Chairman,*
C. T. MESSNER, *Secretary.*

over $2,000. The services of an additional man who could do routine testing, together with a system of procuring certified materials other than by outright purchase of them, would in large measure solve the foregoing problem.

It is earnestly recommended that this appropriation be increased sufficiently to appoint an additional employe to do the routine testing and to cover the cost of needed supplies.

As a general rule, the manufacturers have cooperated wholeheartedly during this fiscal year. In a few instances, certain manufacturers still show a feeling of resentment toward this work. In most cases, this is due to the fact that their products do not comply with the standards adopted by the American Dental Association.

Very little fraudulent advertising of dental materials has appeared during the fiscal year. In one outstanding case, a hearing was held before the Federal Trade Commission. In this particular case, the amalgam was advertised as complying with the American Dental Association specifications, when actually it did not meet the requirements demanded by those specifications.

A hearing was held in this case in the Federal Trade Commission in Washington, Jan. 26, 1934. Wilmer Souder testified for the National Bureau of Standards. C. T. Messner, G. C. Paffenbarger and W. T. Sweeney testified for the American Dental Association. The respondent was not represented at this meeting.

Another hearing was held in New York City, Feb. 1, 1934, at which time W. H. Crawford testified for the American Dental Association. The proceedings of these two hearings will be found in Docket No. 2119, An Official Report of Proceedings Before the Federal Trade Commission in the Matter of the Research Products Corporation.

The case has not been officially closed, since the Federal Trade Commission has not as yet issued its report. The respondent has discontinued the advertising.

### SYNOPSIS OF THE COOPERATIVE DENTAL RESEARCH BETWEEN THE NATIONAL BUREAU OF STANDARDS AND THE AMERICAN DENTAL ASSOCIATION (1933-1934)

The cooperative research work on dental materials for the fiscal year 1933-1934 has dealt with: (1) zinc phosphate cements; (2) cooperative cement work; (3) silicate cements; (4) inlay casting waxes; (5) impression compounds, and (6) vulcanite and its substitutes. (No. 6 by Navy Dental Corps.)

*1. Zinc Phosphate Cements.*—This year's work is a continuation of the study of seventeen trade brands of cement which was printed in the November, 1933, issue of THE JOURNAL. This completes the investigation of these cements.

A method of determining the relative consistence of mixed but unset cement was developed. The amount of powder which each cement required for a definite amount of liquid was determined. Some cements used almost four times as much powder as others and yet had the same consistency at the end of a definite time interval. A method for measuring consistency had to be devised in this laboratory before a satisfactory specification could be formulated.

The time of set and compressive strengths were redetermined on mixes of standard consistency.

Additional physical properties including density of the powders and the liquids, rise of temperature on setting, adhesion to steel, gold, ivory and human enamel and dentin, solubility, film thickness and size of the larger powder particles were measured.

A tentative specification was formu-

lated. Such tests and definite numerical requirements for consistency of mix, setting time, setting temperature, compressive strength, disintegration and film thickness were specified that only the highest grade cements comply with the specification. Heretofore, the dentist has not had any definite standard to follow in purchasing materials of this type.

The detailed report on these cements was presented at the annual meeting of the Association in St. Paul, August 9.

*2. Cooperative Committee Work on Zinc Phosphate Cements.*—Approximately 160 dentists throughout the country are cooperating with this laboratory in the study of these cements. Fifteen practical experiments which the dentists can perform in their own offices, and the necessary equipment for conducting the tests, were mailed to groups of dentists throughout the United States. The cooperators are reporting their findings to this laboratory. Wilmer Souder and W. T. Sweeney discussed the experimental phases of the work with approximately thirty cooperators at the meeting of the Chicago Dental Society, February 26. This project has consumed a considerable portion of the research associates' time, but has proved its worth by bringing such a large number of dentists in intimate contact with the cement investigation. Many of the men are appearing before their local study clubs and societies and are therefore acquainting large groups with the work. The cooperative group is under the direction of R. H. Volland.

*3. Silicate Cements.*—The following silicious cements were purchased: filling porcelain (S. S. White); DeTrey's synthetic porcelain (Caulk); synthay sylikay (Garhart); certified enamel (Smith); artificial enamel (Ascher); enamodent (anterior and posterior); crystone (Harvard). Complete chemical analyses of all but two of the cements were made by Aaron Isaacs. These analyses were a long and tedious procedure, but should be an outstanding contribution, since there is no dental literature giving methods of analysis or information regarding the definite composition of the foregoing materials. The determination of the physical properties will be comparatively simple, since the instruments and tests which were devised for the zinc phosphate cements during the last two years can be applied to the silicate cements.

*4 & 5. Inlay Casting Waxes and Impression Compounds.*—All of the impression compounds and inlay waxes which were certified to the Research Commission by their manufacturers as complying with the specifications of the American Dental Association or which bore a statement guaranteeing compliance with the specifications were purchased on the open market and tested to ascertain whether they did comply. The results of these determinations were published in the April, 1934, issue of THE JOURNAL.

*6. Vulcanite and Its Substitutes.*—(By Navy Dental Corps.) Some determinations on hardness, tensile and impact strengths were made on vulcanite, a phenal-formaldehyde resin ("luxene") and a vinyl resin ("resovin"). These tests were conducted by Com. Ronald Barber of the Navy Dental Corps, who was assigned to this laboratory for a period of six months. This work will be continued next year by the Research Associates of the American Dental Association.

Tarnish Test: A tarnish test involving the use of vapor from ammonium sulphide, devised by Aaron Isaacs, was useful in determining the relative tarnish resistance of gold alloys and amalgams, and is believed to approach some of the conditions of the oral cavity which produce tarnish of alloys.

One manufacturer advertised that an

amalgam alloy with a content of 2.5 per cent gold and 0.5 per cent platinum was unusually resistant to tarnish in the mouth. Discoloration tests indicated that this amalgam was no more resistant to sulphide tarnishing than the ordinary high silver content amalgams.

Another manufacturer of a high palladium-silver content casting alloy advertised that it did not shrink appreciably on casting. This statement does not agree with determinations made in this laboratory. The casting shrinkage is approximately the same as for the usual casting gold alloys. Although the alloy contained approximately 45 per cent silver, it was as resistant to sulphide tarnishing as some 18-carat gold alloys.

One dental school was assisted in establishing a physical testing laboratory. Test data, used in the standardization of equipment and technic, were exchanged with several laboratories. Advice and suggestions on various phases of the testing of dental materials were furnished to several interested parties.

Respectfully submitted,
GEORGE C. PAFFENBARGER,
W. T. SWEENEY,
*Research Associates.*

GRANT NO. 2—UNIVERSITY OF LOUISVILLE

The grant to the University of Louisville, in amount of $750, was used to assist Theodore B. Beust in the research which he has been conducting.

For several years previous to 1932, the Research Commission had been contributing $1,500 annually toward this very important research. Since that time the amount has been reduced to $750, with the result that the work has been seriously crippled. It is earnestly recommended that this amount be increased just as soon as necessary funds are available.

Up until this year, Dr. Beust had written forty-four scientific articles on dental research. During this year, he wrote a short but original textbook on dental histology and embryology, which is now being published by W. B. Saunders & Co. In the preface of this book, Dr. Beust gives the Research Commission of the American Dental Association credit for the inspiration derived from the work supported by it.

SYNOPSIS OF PRESENTATIONS AND PUBLICATIONS BY THEODORE B. BEUST AT THE UNIVERSITY OF LOUISVILLE, SCHOOL OF DENTISTRY, JULY 1, 1933, TO JULY 1, 1934

1. Demonstration of Sclerosis of Dentin in Tooth Maturation and Caries, D. Cosmos, 76:305 (March) 1934.
2. Histopathology of the Dentin and Enamel, J.A.D.A., 21:646 (April) 1934.
3. Microorganisms of the Dental Film, read before the Section on Medical Sciences of the American Association for the Advancement of Science, Boston, Dec. 27, 1933.
4. Results of Permeability Tests on 100 Teeth with Pulpal Involvement, J. D. Res. (April) 1934.
5. Panel discussion on dental caries, held before the American Association for Pediatrics, Cleveland, June 12, 1934. (Beust reports on histology of caries; influence of environment on caries; vitality of the tooth.)
6. Exhibit included in the Scientific Exhibit at St. Paul, Aug. 6 to 10, 1934; title "Variability in Tooth Structure"; containing more than forty enlargements of tooth sections.
7. Development of Dentin Sclerosis, J.A.D.A., to be published.
8. In preparation: "Bacteriology of Peridental Inflammations"; to be read before the Ohio State Dental Society, October, 1934.

Respectfully submitted,
J. T. O'ROURKE,
*Advisor.*

GRANT NO. 3—NEW YORK INSTITUTE OF ORAL PATHOLOGY

The work at the New York Institute of Pathology is a new project as far as the Research Commission is concerned. A grant of $750 was allocated for this project in the last meeting of the Commission, Aug. 9, 1933. Owing to the fact that funds were not immediately available to the Research Commission, this project was held up until Jan. 1, 1934. The Chairman of the Research Commission made a trip at his own expense to New York to investigate this project before the grant was made.

SYNOPSIS OF RESEARCH BEING CARRIED ON AT THE NEW YORK INSTITUTE OF CLINICAL ORAL PATHOLOGY, INC.

A. *Pulp Test Study.*—Complete studies were made of 130 teeth including clinical examination, roentgen-ray examination, pulp testing and histologic study. Any marked systemic disturbance was also recorded in our findings. Up to the present time, the work has progressed as follows:

1. Definite confirmation has been made of the findings of Doctors Reiss and Furedi with regard to the Columbia instrument. ("Significance of the Pulp Test as Revealed in a Microscopic Study of the Pulps of 130 Teeth," D. Cosmos, 1933.)

2. A comparative study of the Columbia and Cameron instruments has been made, determining the relative diagnostic value of each instrument.

3. The accuracy of pulp testing as a diagnostic aid in single and multi-rooted teeth has been determined.

4. The reliability of roentgen-ray findings of the pulp canal and pulp chamber has been checked by histologic examination.

5. Histologic studies of dental pulps in various stages of peridental disease have been made.

This study, which is a continuation of Reiss' and Furedi's work, will be practically completed for presentation before the American Society of Oral Surgeons and Exodontists at the August meeting in St. Paul.

B. *Comparative Roentgenologic and Histologic Study of Unclassified Benign Bony Growths of the Maxilla.*—This study combines thirteen cases and the study is correlated with a study of conditions known as localized and generalized ostitis fibrosa cystica and central giant-cell tumor (eleven cases); and, furthermore, with a comparative study of giant-cell epulis (thirty-two cases).

C. *Adamantinomas, Solid and Cystic.*—The study is of roentgenologic and microscopic findings, microscopic findings and relative malignancy, microscopic findings and radio-sensitivity.

Respectfully submitted,

THEODOR BLUM,
*Advisor.*

GRANT NO. 4—RESEARCH IN RICKETS, JOHNS HOPKINS UNIVERSITY AND HARRIET LANE HOME

For the research in rickets, the Research Commission allocated $700 at its last meeting, in August, 1933. Owing to the fact that all funds were not immediately available to the Research Commission, this project was held up until January 1, and plans to start it were not definitely completed until April 1.

C. T. Messner, secretary of the Research Commission, personally investigated this project, and, with H. E. Kelsey, member of the Executive Board of the Research Commission, and advisor, and Edwards A. Park, chief of the pediatric service, Johns Hopkins University, completed arrangements whereby this inexpensive, but very valuable project, might be carried forward in cooperation with the excellent staff of experienced

workers at the Harriet Lane Home, Baltimore.

The sum of $200 was contributed to this fund by Miss Etta Cone as a memorial to her sister, Dr. Clarabelle Cone. This contribution was given through H. H. Streett, of Baltimore.

Edwards A. Park, chief of the pediatric service, Johns Hopkins University, is deeply interested in this project, and his long experience in the study of rachitic children makes his counsel and advice of great value. H. E. Kelsey, a member of the Executive Board of the Research Commission, has acted in the capacity of advisor for the project, and he, with H. Hayward Streett, G. M. Anderson and Dr. Shelling, has contributed a great deal of his time.

As of the date of this report, 122 children ranging in age from 3 to 15 years and who have had active rickets during infancy or early childhood have been examined. The study will be continued until approximately 150 rachitic children have been examined.

It is earnestly hoped that this study can be continued during the next year in order that a control group of children known to be free from rickets since childhood may be examined. Such a project as this could be carried to completion only under the supervision of such an institution as the Harriet Lane Home, as its valuable records covering a period of many years are available and can be freely utilized. This project is costing the Research Commission only a very small sum.

In his report to the advisor of the Research Commission, Edwards A. Park makes the following recommendation: "It would be a splendid thing if it could be arranged in such a way that these two groups, (*a*) the former rachitic children, and (*b*) rachitic free children (protected children) could be followed until they are 10 years old in order to study the permanent as well as the temporary teeth. Perhaps financial arrangements could be made which would render this possibility a certainty."

### SYNOPSIS OF RESEARCH IN RICKETS, JOHNS HOPKINS UNIVERSITY AND HARRIET LANE HOME

To date, 122 children have been examined in the dental clinic. Their ages range from about 3 to 15 years. Each one has had active rickets—diagnosed by the roentgen-rays—during infancy or early childhood.

Analysis of the accumulated data has not been completed. The problem will be approached with the following questions to be answered:

1. The incidence of dental hypoplasia in the rachitic group: (*a*) in those tested with vitamin D; (*b*) in those cases not treated with vitamin D, but healed spontaneously.

2. The incidence of dental caries: (*a*) in those treated with vitamin D; (*b*) in those not treated with vitamin D.

3. The relation of malocclusion to rickets.

4. The relation of hypoplasia and caries to the age at which rickets was probably most active; i.e., whether it was early or relatively late rickets.

5. The relation of tetany to dental defects.

6. Effect of decalcification process (for correction of deformities) on dental tissue.

7. The relation of the diet to dental caries, especially with respect to likes and dislikes for milk, meats and vegetables. (Tentative.)

8. Effect of chronic infections and metabolic ailments on dental structure.

Of course, study of the problem as it stands now is only half finished. Another group of children is necessary to study

the effect of prophylactic vitamin D therapy on dental structure. We have such a group of about 450 children who have received viosterol in infancy, many of whom are now getting their permanent teeth. Unlike the rachitic group, which is composed mostly of colored children, the prophylactic group contains about an equal number of white children; hence, it will be possible to ascertain the correctness of the supposed predisposition of the white race to dental decay. The plan, for next year, therefore, is to study the group in the same manner that the rachitic group was investigated this year, namely, a physical examination, dental roentgenographic examination and a study of malocclusion, hypoplasia and caries. As in the rachitic group, each child in the prophylactic group has had a series of roentgenograms during infancy and the absence of rickets in each one is therefore definitely known.

Respectfully submitted,

HARRY E. KELSEY,
*Advisor.*

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# THE IDEAL AMALGAM RESTORATION*

By HAROLD E. TINGLEY, D.M.D., Boston, Mass.

WEBSTER defines the adjective "ideal" as meaning "conforming to a standard of perfection." While it is difficult to qualify perfection in anything, we should do so, I believe, when we allude to perfection in amalgam work. It is doubtful that any authority believes a state of perfection to exist in amalgam restorations. This lack of accomplishment is due mainly to the complexity of the multiple physical and chemical factors involved and to an indifferent technic.

Since its adoption in the field of dentistry, amalgam has been the subject of many empiricisms; which is one of the reasons that the scientific study of amalgam has progressed so slowly until comparatively recent years.

At the present time, the laboratory study of the physical and chemical properties of amalgam is, I believe, ahead of our study of the development of an accurate and a scientific technic.

Pond states that 75 per cent of restorations are today made with amalgam. If this is true, amalgam is a material which deserves all the study that can be given it. It has been said many times, and I hesitate to repeat it, that "amalgam is the most widely used and abused of filling materials." If this statement is true, and it undoubtedly is, the time has come when empiricism should be cast aside and amalgam restorations made according to the latest scientific knowledge on the subject.

Paffenbarger and Sweeney state:

> The Research Commission has directed its research associates to purchase in the open market materials that are guaranteed by their makers to meet the various American Dental Association specifications and to test these materials for compliance with these specifications. Thus, by these check tests, the profession will be further protected against inferior

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 11, 1933.

products. Likewise, the manufacturer who is actually producing specification materials and has adequate testing facilities will also be protected against unfair trade practice.

I believe that every practitioner is in sympathy with the above-mentioned report. Such precautions are bound to be reflected in an improved product, and no stone should be left unturned to improve our dental materials. The last sentence of the last paragraph of this report seems to me the most pertinent: "It is felt that these safeguards will protect the dentist in the purchase of satisfactory materials. It is then his duty to employ them correctly."

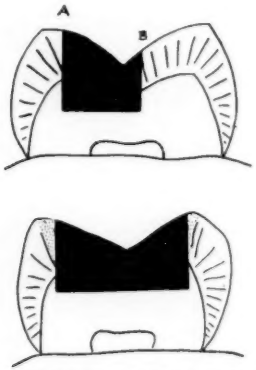


Fig. 1.—Above, *A*, frail enamel, which is likely to fracture under stress. The enamel margin at *B* is much stronger. Below, shaded areas indicating probable enamel fractures resulting from placing margins in critical location; i.e., near tips of cusps.

The implication from the foregoing sentence is, I believe, a challenge to the dentist to exert his best efforts in the use of dental materials. In the last analysis, this means that the use of the materials should be based on scientific findings. One has only to refer to Ward and Scott's recent report to learn that even the use of a differently surfaced mortar and pestle will make a measurable difference in volumetric behavior of amalgam.

Knowledge of physics and chemistry is sufficiently complete at this time to assure us safe materials and safe technic. By safe, I mean materials and a technic which will give us more accurate clinical results than were ever before obtained. Credit and recognition should be given to all the investigators of amalgam, but especial appreciation should be accorded the men at the Bureau of Standards. The efforts of Souder, Taylor, Sweeney and Paffenbarger were unquestionably of outstanding merit; for their contributions definitely improved the quality of dental alloys on the market today.

The recent work of Ward and Scott

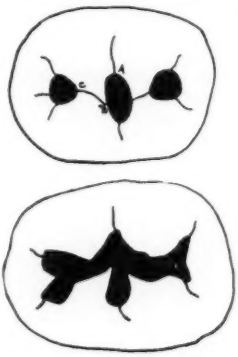


Fig. 2.—Above, *A*, *B* and *C*, points making adaptation and finishing a difficult task. Below, sharp, irregular angles in outline form, which make adaptation and finishing difficult.

deserves mention and recognition. The report recently made by them was another milestone in our progress toward ideal amalgam restorations. Harper should receive great credit for his contributions and untiring efforts in the field of amalgam. He has undoubtedly done more than any other investigator to improve the amalgam technic of dentists.

It is unquestionable that the higher grade alloys must be available for the dental profession. High silver alloys of favorable proportional contents are the

only safe materials to use, since the best clinical results can be obtained only from high grade alloys of a known and favorable physical behavior. Volume changes alone vary sufficiently in alloys selected at random to make it necessary to choose a high-grade alloy in order to insure good results.

An accurate and painstaking technic is of little help if the basis of the technic is the employment of a poor alloy; yet, conversely, the use of a high-grade alloy combined with an inferior technic will not give satisfactory results either. The question at once arises as to whether the use of a good alloy or good technic is the more

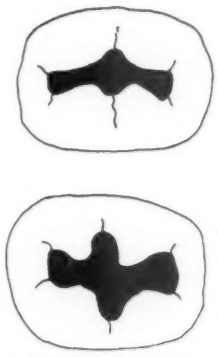

Fig. 3.—More orthodox and desirable types of outline form than that shown in Figure 2.

important. One cannot fairly make such a differentiation; for both are important, and without both, excellent results cannot be obtained.

It is apparent, therefore, that many failures with amalgam are traced by those responsible to the chemical and physical properties of the alloy when only a poor technic is responsible. Faults such as poor condensation, ill-shaped contours, cervical excesses and overhangs cannot be properly attributed to the use of a low-standard alloy. Broadly speaking, it would seem that the average dentist is far more interested in the selection of a proper alloy than in the utilization of an improved technic, and such an attitude should be subject to modification. Obviously, lack of care in the use of amalgam is due to carelessness, and is generally the result of a belief on the part of the dentist that he is dealing with an inferior filling material which it is not necessary for him to manipulate with precision. It is not the purpose of this paper to champion amalgam over and above its value; yet it is only fair to state that amalgam deserves a high rating as a tooth-saving material.

Most practitioners agree that gold is the filling material par excellence; yet Pond states that he believes amalgam to be a better restorative material than in-

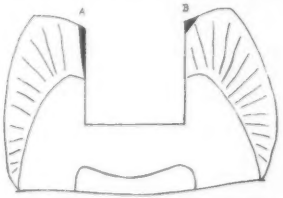


Fig. 4.—Comparison between amalgam bevel illustrated at *A* and bevel for gold illustrated at *B*. The amalgam bevel should be three-quarters to full length of the enamel wall, varying but slightly in its direction from the cavity wall.

lays made of gold. Certain it is that thousands if not millions of teeth are saved yearly in this country by the use of amalgam. Amalgam has its faults—plenty of them—but if the material is understood and its physical properties observed, many of these deficiencies can be sufficiently controlled to give us very good results.

Some of the disadvantages which may be attributed to amalgam are: relatively low tensile and edge strength; a crystalline make-up, which defeats attempts to burnish it; expansion and shrinkage; a

tendency to discolor in the mouth, and thermal conductivity. Spheroiding is not mentioned in the foregoing list because it is quite probable that this phenomenon should be properly included in the volume changing factors of expansion and shrinkage. Let us discuss briefly the deficiencies above related and attempt to point out the seriousness of each, taking them in the order of their importance. Shrinkage is without doubt the most detrimental physical characteristic which amalgam possesses. It has the effect of pulling the restoration away from its cavity walls, thereby exposing such areas to bacteria and decay—not to mention the discoloration which results when these surfaces are exposed to the fluids of the

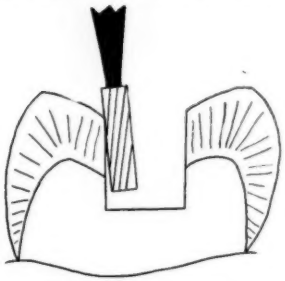

Fig. 5.—Use of spiral plane fissure bur No. 56 or 57 for finishing enamel wall.

mouth. Shrinkage also impairs the mechanical structure of the restoration by drawing the amalgam away from its supporting walls; but shrinkage can be controlled to a large extent by the selection of a high-silver-content alloy and by the complete removal of excess mercury, accomplished by thorough condensation.

The next most important physical disadvantage associated with amalgam is its apparent crystalline formation. This type of structure hinders us in the removal of the excess mercury owing to the evident temper which the amalgam exhibits when exposed to pressure during condensation of the filling. Such residual excess mercury will produce serious volume changes; which, in turn, will adversely affect the durability of the restoration.

The crystalline physical characteristic prevents the burnishing of the margins of the filling as is done when using gold. This, to a large extent, precludes good adaptation to the cavity walls if an error has been made at the cavosurface angle in carving or preparing the cavity. This point illustrates definitely the precision required in the technic. The disadvantages of this crystalline makeup can be controlled by employment of the amal-

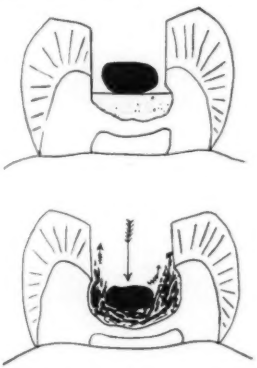

Fig. 6.—Above, hardened cement base with amalgam ready to adapt to cavity. There is a flat floor and clean walls. Below, amalgam in soft mass of cement showing irregular floor and inevitable result when pressure, as indicated by arrow, is applied.

gam before the initial crystallization has started and by the use of suitable pressures at the proper times during condensation of the filling.

The low tensile and edge strengths are factors in the failure of restorations when beveling of the enamel walls of the prepared cavity necessitates the drawing out of the amalgam into thin edges. Such edges will, of course, fracture, imperfect

margins resulting. This characteristic can be controlled to a large degree by proper treatment of the enamel wall.

Where tensile strength is needed for retentive purposes, a sufficient bulk should be given to the preparation to provide essential strength to the filling material at that point.

The discoloration of amalgam and, subsequently, of the tooth structure, which is indeed a serious fault, implies that its use should be confined mostly to the posterior teeth. Some years ago, G. V. Black pointed out that discoloration of the tooth structure resulting from the placing of amalgam occurs only where there are leaky margins. He advanced

Fig. 7.—Carving direction with spoon or carving instrument, from tooth structure toward central part of restoration area.

the theory that the metallic salts and hydrogen sulphide would penetrate the dentinal tubules only when moisture was present. Comparatively nothing has been brought out in recent years for or against this theory, which indicates that the control of this condition may be accomplished by adopting a technic that will insure impermeable margins. The discoloration resulting from the presence of unsupported enamel can best be controlled by its removal or by the use of a light colored cement lining. The discoloring tendency of amalgam is indeed unfortunate, and, accordingly, the use of this material should be confined to teeth and surfaces of teeth which are not exposed to view. The use of amalgam in the lingual pits of maxillary anterior teeth is dangerous in this respect, and for these cases no better material than gold can be found.

It is apparent that expansion is not an unfavorable factor except in poorly balanced alloys; i. e., alloys which have an unusually high silver content, and there are none of these on the market. Prolonged expansion up to a period of a ten-day ultimate expansion is desirable. If there is need of controlling expansion, it should be done by selecting an alloy which is not above 70 per cent in silver content.

Thermal conductivity is undesirable in any filling material, since lasting injury to the pulp may result. The thermal conductivity of amalgam is, I believe, sufficiently below that of gold to be more desirable material in this respect. Thermal conductivity should always be considered when impending irritation to the pulp is anticipated. Cavity lining and cement are probably the best means of insulation in these cases.

In addition to the above-mentioned physical and chemical shortcomings of amalgam, considerable attention has been given in the dental literature to flow, spheroiding and mercurial poisoning. In a discussion of alloys of high silver content, flow ceases to be a factor to any dangerous extent. The presence of, let us say, 68 per cent silver, 26 per cent tin, 5 per cent copper and 1 per cent zinc raises the crushing strength sufficiently to eliminate flow from any great practical consideration. Much has been written about that unusual and inexplicable phenomenon, spheroiding. The theory has been advanced that any alloy containing mercury tends to become spheroidal because mercury in its separate and uncombined state has that tendency. The

amount of uncombined mercury in an amalgam restoration would, of course, vary with the technic of manipulation. It is hard to believe that a sufficient amount of free mercury exists in a well-condensed filling to allow this action to take place. This statement is made guardedly, as there is no proof for it at hand; but it would seem that, for our answer, we should look to the volume changes which might result from extreme temperature variations in the mouth. For example, there is a considerable temperature spread between a cup of hot coffee and a dish of sherbet, and the relative volume coefficient value of amalgam is high for the metals. Taylor states that measuring by thermocouple the temperature of an amalgam mix triturated in a mechanical mixer showed a rise in temperature of from 20 to 25 degrees Centigrade, and the amalgam did not behave well afterwards. If this is true, is it not a logical deduction that greater temperature variations, such as are found in the mouth, will inevitably cause much volume change in amalgam restorations?

At the present time in this country, there seems to be no general belief that mercurial poisoning may result from the presence of silver amalgams, although Germany has many adherents to this theory. Saliva in which silver amalgam was immersed for six weeks showed no mercury and only slight traces of tin. As the salts of tin are not particularly harmful, if these experiments were exact, mercurial poisoning may be dismissed from our minds. As regards this point, a number of German investigators have shown that copper amalgam gives off mercury in proportionally large quantities. There also have been several cases reported of severe poisoning, but it must be remembered in this connection that copper amalgam is much less stable than silver, especially in the fluids of the mouth. Copper amalgam is well on the road to being discarded in this country, although abroad it is still in general use. It was heralded in the past on its supposed germicidal merits and became touted as the panacea for all ills in children's teeth. True, it may have had germicidal merits, but its instability in the fluids of the mouth render it generally unfit for use.

Before proceeding with an advocated technic, let us consider briefly the makeup of an alloy and also the phenomenon of what is called the setting of the amalgam. Most high-test alloys have an element content which compares closely with the following formula: silver 68 per cent, tin 26 per cent, copper 5 per cent and zinc 1 per cent. Every alloy should have a high silver content; which promotes expansion, thereby controlling excessive shrinkage. The use of silver also increases edge strength, controls flow and hastens setting. The tin contracts and its employment decreases edge strength, increases flow, retards setting and adds plasticity. The use of copper increases edge strength, at 5 per cent or less, hastens setting and decreases flow and there is little change in volume. The zinc content increases edge strength, lessens flow, improves color and adds smoothness to the amalgam. Silver and copper unite with mercury with greater difficulty than does tin or zinc, and tin has an exceptional affinity for mercury; which makes it a dangerous factor in this respect. A high silver alloy will not work so smoothly as one containing a large amount of tin, but shrinkage can be controlled only by using a high silver content. Practitioners should, therefore, avoid excessively smooth amalgams as these usually shrink greatly on account of the high content of tin.

The trituration of an amalgam in the mortar and the subsequent mulling in the hand are accompanied by shrinkage which

is the result of the fact that alloy filings go into solution with the mercury. This, which is called the primary shrinkage, is followed by a primary expansion which is the result of the crystallization marked at the start by a slight crepitus in the mass. The duration of this primary expansion period is approximately twenty-four hours, after which the residual excess mercury diffuses through the amalgam and the remaining particles of alloy go into solution, this causing a secondary shrinkage. The subsequent crystallization, which is known as secondary expansion, is desired at the end of approximately ten days. If this sequence of events occurs as claimed, any margin that is finished before the expiration of that time will fail.

There is a period which lasts from the completion of the mixing until about ten minutes have elapsed, during which time the amalgam is more easily adapted to the cavity walls. This period, which is called the period of adaptable plasticity, varies in length with the type of alloy employed, being of shorter duration in high-silver-content amalgams. There should be relatively little crepitus in the amalgam during the period of adaptable plasticity. Immediately following this, there is a period of lessened plasticity, which continues until the amalgam ceases to be workable. This is called the period of workable plasticity. During this period, the amalgam may still be used, but good adaptation to the cavity walls will not be effected and difficulty will be experienced in removing excess mercury. The foregoing facts are practical points, easily demonstrable by experimentation. The greatest success is obtained only by exercising regard for these periods in the setting of the amalgam.

Cavity preparation is an important part of amalgam technic. Restorations usually fail if preceded by poor cavity preparations. There is no step in amalgam technic that is more important. Fundamental principles of cavity preparation must be followed, and such principles should evolve from a complete familiarity with the anatomy, histology and pathology of the tooth.

There are, briefly, two types of dental caries: the pit and fissure type and the smooth surface type. The former attacks the tooth through structural defects; the latter, by the formation of plaques on the smooth surface of the enamel within the vulnerable or especially susceptible areas. In the first type, the limits of the caries are not usually known until the cavity is partially prepared and, obviously, two cavities of the first type in the same tooth should not be filled separately until it has been definitely established that they are not intercommunicating. In the pit and fissure type, caries seldom spreads on the surface of the tooth, and this fact makes it unnecessary to "extend for prevention" except to include pits, fissures and deep grooves. In the smooth surface type, the operator should not, of course, limit the extension of the cavity outline until all carious and susceptible areas have been included. In this respect, special attention should be given to cavities on gingival third of the tooth, as decalcified enamel will not be detected unless the surface of the tooth is dry. Cavities of this type present a problem in mouths wherein caries susceptibility is high. Generally speaking, their outline forms should be proportionately extensive.

The direction of the enamel rods modifies the treatment of the enamel and the directional placement of the cavity walls. The rods radiate from the pulp, converge in approaching grooves and change direction acutely at cusps and ridges. Accordingly, cavity enamel walls are stronger when placed near the grooves.

Pit and fissure cavities should be extended to include all caries, pits, fissures and deep grooves, as it is almost impossible to finish properly the margin of a restoration which crosses a deep groove. Marginal ridges should not be encroached on or undermined with inverted cone burs. There should be no sharp angles in the outline form and the floors should be flat; in a parallel plane to the surface of the tooth, and always well seated in the dentin. The walls should be parallel and at right angles to the floor, with the exception of the slight retentive form made at the floor with an inverted cone bur and sharp hand instruments.

The enamel margins should be beveled from three quarters to the full length of the enamel rods, flaring but little from the direction of the wall. A plain spiral fissure bur of moderate size is, I believe, the best instrument for this purpose.

The occlusal dovetail, the chief source of retention in compound cavities in the posterior teeth, should follow the groove toward the buccal aspect. Especially is this true in the maxillary teeth. Constricted portions of the cavity should be made sufficiently wide and deep to compensate for the low tensile strength of amalgam. Buccal and lingual walls should be extended to self-cleansing areas and, if possible, should be kept within the angles of the tooth. Gingivally, the extension for prevention is made to a point under the normal free gingival margin. The gingival wall should be at right angles with the axial wall, as well as parallel to the floor of the dovetail.

Amalgam requires somewhat more retention than malleted gold; and owing to this fact, substantial retentive points are placed in the proximal portion. The buccal and lingual enamel walls are finished by planing with sharp chisels, and at the gingival enamel wall, Black's gingival margin trimmers are used.

Caries frequently is extensive and, in such cases, an intermediate filling material is indicated for the protection of the pulp. Zinc oxyphosphate cement seems best for this purpose. Guttapercha should not be used, because of its tremendous coefficient of expansion; i.e., 198, as compared with a tooth substance value of 8 and an amalgam value of 25, to say nothing of a mercury value of 60. Little is known of the volumetric change of zinc-oxide and eugenol and, as an intermediate, it should probably be confined to simple cavities.

Pond states that he prefers to cement all his amalgam restorations with a soft mix of cement. I believe that it is better to allow the cement base to harden before attempting to place the amalgam, for the following reasons: 1. Cement is usually indicated as an intermediate filling when insulation from thermal shock and protection from pressure of condensation is needed. A thicker layer of cement should give greater protection from both of these factors. 2. One of the objects of condensation is to eliminate as much excess mercury as possible, and it seems more feasible to have a flat floor against which orderly condensation may be directed. It is extremely difficult to express mercury from an amalgam filling in a cavity which has a concave floor. 3. There is always the danger of touching the matrix band or cavity margins with the soft cement.

Matrices are necessary in compound cavities and for general use "ivory" 1, 4 and 8 are recommended. "Ivory" 1 and 4 may be used on mesioclusal and distoocclusal cavities, while 8 is quite suitable in mesioclusodistal and larger restorations. The separation of the teeth and the adaptation of the 1 and 8 matrices at the gingival aspect is obtained by using

a wooden wedge for this purpose, a round toothpick properly trimmed being suitable in the average case. It usually is best to trim the matrix band to suit the case at hand and the bands may be burnished to obtain the desired contour, proximal or otherwise. The tension on the matrix band should be released slightly when the height of the filling reaches the contact point. This helps in obtaining the proper contact. The matrix band should be removed as soon as the condensation of the filling is complete as the friability of the amalgam increases very rapidly as crystallization progresses. The matrix should be rotated toward the gingival aspect and from buccal to lingual, but never toward the occlusal. It is best to cut the matrix band as near the contact point as possible before attempting its removal, and pressure should be kept on the filling during this procedure to prevent the displacement of a portion of the filling material.

In the mixing of the amalgam, known volumes, measured by weight, of mercury and alloy filings are placed in the mortar. The proportion of the mercury to the alloy is not especially important except that it should be constant. The time of mix is exceedingly important, as prolonged trituration and vigorous grinding promote shrinkage. The mercury content should be reduced slightly when multiple portions are used, and this reduction does away with any excess of mercury in the mix. It is best to use the proportions recommended by the alloy manufacturers. The proportions of eight parts mercury to five parts alloy are suitable for most high grade alloys. Crepitus should not be present in the mix, yet the mixture should not be excessively thin. A good consistency test may be made by dropping the spherical mass of the mix onto a flat surface from a height of 6 or 8 inches; after which the mass should be flattened out approximately one-half its diameter. The alloy and mercury should be lightly triturated in the mortar for two minutes and mulled in the hand for one minute. This procedure should be timed and the mixing should not exceed three minutes.

Condensation is accomplished by placing in the cavity the first portion of the amalgam from which no mercury has been removed and carefully tamping it to place. Tamping adapts the amalgam to the walls, as well as sharp angles, and this process should not be confused with forceful condensation. A small amount of mercury is then removed from the second portion, which is placed in the cavity. At this point, condensation is started. Orderly packing of the amalgam is accomplished by starting in the center of the cavity and packing toward the walls, overlapping the previously condensed area with each thrust of the instrument, and continually driving the mercury in one direction. A strong force of from nine to sixteen points pressure should be applied. This method carries the mercury toward the walls, where it is finally expelled by the filling instrument. The above-described process is repeated, expelling more and more mercury from the amalgam before it is inserted in the cavity. Still more mercury is expelled in the process of condensation. The last portion of the amalgam used should be very dry and packed into the cavity with great force of the hand instrument, if not malleted. At the completion of the condensation, a substantial excess of amalgam should always exist for the convenience of carving. The whole purpose of thorough condensation is to effect proper adaptation to the cavity and to expel as much mercury as possible. The behavior of the finished filling is largely dependent on the thoroughness of this process of eliminating excess mercury. Volume, crushing strength, marginal friability, all

will be affected if the excess mercury is not removed.

The function of amalgam restorations is to restore anatomically lost tooth structure, in order to preserve the health of and restore function to the teeth and their investing tissues. By the same token, anatomic form must be reproduced in order to restore the teeth to their original use and function. Proper contact points should be made with the approximating teeth and should be located well toward the buccal third of the tooth. If the contact point is not normally present, it is best to improve on nature by developing a contact, when the distance is not too great. Such a contact point should be convex and not a broad surface, in order to preclude decay of the adjacent tooth. The operator will, by obtaining a contact point, prevent the impaction of food and stabilize the tooth as to its normal position and mobility.

Marginal ridges are restored to an equivalent height of the marginal ridge of the adjacent tooth as this will further prevent the wedging of the food into the interproximal space. Buccal and lingual embrasures are made to resemble wide open V-shaped spaces and should not be reduced to the narrow places which are often caused by too great convexity of either the buccal or the lingual aspects of the approximal surface.

The cusps should be reproduced as to their original form, the tips being placed well toward the center of the tooth. Especially should this be done in the cases of buccal cusps of the lower and lingual cusps of the upper molars. The principal grooves should be reproduced, particularly grooves separating cusps, as well as the triangular grooves which are present in practically all mesial and distal fossae of the posterior teeth. Spillways may be reproduced when the approximal surfaces are broad. Interproximal spaces should be preserved to allow the interdental papilla to take its natural position. On the whole, anatomic form must be understood before it can be reproduced, and the occasional carving of a tooth serves to keep the practitioner interested in the production of good tooth form. The study of dental anatomy may be elementary but is certainly fundamental.

If condensation has been accomplished, carving may be started at once. The carving instrument should always be directed from the tooth structure to the amalgam, and burnishing should not be attempted, reports to the contrary notwithstanding. Excessively deep grooves should be avoided and marginal ridges should be made the lowest points on the surface of the tooth, with the exception of pits, fissures and grooves.

The finishing and polishing should not be attempted for twenty-four hours, or, better still, ten days. The technic of finishing consists of trimming the occlusal margins with finishing burs until they are flush with the surface of the enamel. This operation should be repeatedly checked with a sharp explorer and there should be no catches. On the proximal aspect, the buccal and the lingual margins are trimmed with sandpaper disks, then the gingival margin is surfaced with fine sandpaper strips. The entire proximal surface is finished with fine cuttlefish strips and the occlusal with midget disks. At this point, all scratches will have been removed and the occlusal surface is further finished with rubber cups, moist pumice being used as an abrasive. This is followed by moist whiting, and the polishing is done by using nearly dry tin oxide powder. The same procedure is followed for the proximal, linen strips carrying the polishing material. If each step is followed in the proper sequence, a restoration of high luster and flawless margins will result.

CONCLUSIONS

1. It is essential to use a high test alloy with an adequate silver content.

2. A good standardized technic is as important as the selection of the alloy.

3. Cavity preparations should be carefully made.

4. All excess mercury possible must be removed to insure nominal volume changes.

5. Amalgam has such structural composition and physical characteristics that it becomes necessary for the practitioner to exercise great care in its use to obtain good results in the restoration of the teeth.

6. Great good would result from a conference of the leaders in amalgam work in the profession, and such a conference would be of value in the development and improvement of amalgam technic.

12 Bay State Road.

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# THE RELATION OF CERTAIN PROFESSIONAL TRENDS TO PRIVATE PRACTICE*

By JOHN F. CHRISTIANSEN, M.S., D.D.S., F.A.C.D., Los Angeles, Calif.

WHEN income gradually decreases over a prolonged period of time, the mental conception that a "safe refuge lies somewhere in socialism" seems to need but little support to bring belief in its plausibility and trustworthiness. Thus, the concept of socialism becomes rather falsely idealistic to a proportion of the profession and, perhaps, an interesting topic for academic discussion to us all.

It may not be well understood, nor acknowledged, that limited socialized health service already exists, and that the extension of the form now established will make socialization only more nearly complete. The long-established United States Public Health Service and the state boards of health render service of a socialized type in that they provide free diagnostic clinics and afford hospitalization, and their staffs offer free assistance in making diagnoses from free bacteriologic examinations. All the dentists and physicians on the government payrolls are thus practicing a form of limited socialized health service. Incidentally, our public school system is socialized, even if it is supported by public taxation; and the army is the height of socialism. Likewise, all other similar boards or departments paid out of the public treasury, such as fire and police departments, are socialized according to the ordinary meaning of the term.

At the present time, the government does not interfere with private medical or dental practice except to the extent that private practices necessarily contribute indirectly to the expenses of the medical budget of the government. A sympathetic inclination toward socialized dentistry means, of course, among other things, being attuned toward control of our profession and its activities by the government. Presumably, central control would provide a regular income, and designate quite acceptable working hours.

*Read before the Utah State Dental Society, Salt Lake City, June 1, 1934.

Possibly, it would reduce overhead cost, and thus lower average fees, but the principal argument for central control is, that "it will afford relief from economic stresses of private practice."

Those who hold contrary notions fear inconstancy or discord under political dominance. They assert that the capacity to earn a livelihood unaided by any form of subsidy exists within professional memberships; and express their preference to utilize personal talents without direction from a designated source. In general, it is insisted that a loss of personal incentive in the performance of one's work and the loss of initiative, which means conceiving of things to be done without being told about them, are embodied in any plan which denies, more or less, individual initiative in professional life and work and in any other form of human endeavor.

We talk rather glibly of proposed measures for the reorganization of our efforts "to provide a still greater extended dental service," but when powerful forces direct attention to the necessity for effectual enlargement, the profession should give thought and study to the possibility of compliance therewith. Our resourceful President Roosevelt recently called on organized dentistry "to exercise its professional obligations and extend dental service to a larger part of the community." Perhaps this problem is not ours to solve. Government is said to function in accordance with the strong expression of opinion of the people at large. Socialization of dentistry may occur, not necessarily if the profession wishes it, but if and when the people make bold enough to demand it. In theory at least, one observes that the public does not exist for dentistry, but dentistry for the public.

Free health service as a necessity is being instilled gradually in the thoughts and minds of the people. This trend is emphasized by the government and state free clinics, established to cover the period of economic imbalance, and also by the 1,500 or more free or part-pay dental clinics now in operation in our country. Presumably, these clinics are conducted in the interest of patients classified as "in the lower financial brackets." Group clinics, health institutes, health centers, rapidly increasing in number, give impetus to the belief that health aid should be furnished gratis or at a minimum expense. The idea that all health service is a right of citizenship, the same as bodily protection, is gaining support in certain large social groups. Increased experimentation in providing free health service appears to be another step in the direction of popular demands listed under the name of social progression. The order of the day is change, motion, and action—irrespective of known values, direction, results or time-honored practices. Usually, the public demands that of which it is reminded. The public attitude is impressed by, and is inclined to adopt as its own, that which it reads and that which it sees. Tell an individual or a community anything long enough or often enough, and faith in its truth will almost certainly be established.

"Clinics," health centers and low-fee advertising offices that fix fees or prices so that the least efficient can make a profit, and in which real dental service is slighted in order to make profit, are gaining in patronage. This type of service and the general unbalanced ratio of income to expenses account for the diminishing income of the private practice. If the present economic conditions were to continue over a long period of time, there would be danger of a permanent shift in the demand for dental service to such institutions, whether privately owned or under state

control, and particularly so if price levels below those economically possible in private practices are maintained.

No one concerned believes that the new forms of practice procedures will apply for only a few months or that precedents established will fail to be considered at some future time. Evolutionary periods are not measured by the year or by years; one does not recognize the lines of demarcation where one system ends and another begins. If it appears that socialized medical and dental services are creeping upon us, can the professions control the trend, or only hope for public reaction against impersonal service through the return of normal conditions in the economic world? Probably, there is need for the professions to become more fully conversant with the advances made toward socialization in health service, if for no better reason than to protect its professional ideals and traditions. The recent advances will make patterns to be utilized in further extended changes, especially in reference to payment for services.

Most of us cannot believe institutional dentistry will ever concern itself with the welfare of the people to a greater degree than does the private practitioner, or that "problems too difficult to solve by our profession can be handled by a selected few in control of social units, even with (or plus) governmental assistance."

Institutional or corporation management of health service is a means of shifting individual duty and responsibility. This is one of the reasons for the enactment of laws which tend to limit or prohibit the formation of close professional units. A California law, in effect since August, 1933, gives authority to the state board of health to make rules for the maintenance, conduct and operation of clinics and dispensaries; and to secure sufficient information regarding the necessity, basis and method of appealing to the public for support thereof; to show the need of the community or persons advised or treated, for the service rendered.

It is a duty and the sole responsibility of the profession to administer health service free from "outside" controls. Domination by politicians or the permission for political intrusion will develop hindrances to our professional advancement and welfare.

Planning for the profession's advancement was first undertaken by our dental organization in 1833—just 100 years ago. These plans have grown slowly but steadily, always with the aim and objective of rendering the best and most scientific dental service. This does not argue that we have no problems to solve. However, there should be sincere loyalty to an established system which conceives its work as a service to the whole community and which has produced a praiseworthy standard of efficiency. Threats to our organization plans and activities must be combated if our individual professional welfare is to be preserved. Let us all remember that professional welfare lies in our unity of action.

At this particular time, driving social and economic forces seem to have brought new problems relative to both the rendering of and the payment for the work we perform. On these scores, our national organizations are politely called to find ways and means for a still wider distribution of our services. The inference is that old or standard models or patterns for rendering service are inadequate and decadent in that they "fail to reach or include the larger part of the community" because of high payment barriers maintained by the profession.

Through many years, the principal method of service distribution has been through the thousands of private offices

wherein, in theory and actuality, only two persons—practitioner and patient—are involved. It is believed that this method preserves and maintains a necessary confidential relationship and also places certain individual responsibilities on endeavor; likewise, that it gives opportunity for selection or choice by those who desire professional aid from certain practitioners. These have always been considered important values in health care; certainly they do not constitute a menace to professional values. Conversely, it is doubted that the health welfare of the patient or the dentist-patient relationships would be so satisfactorily maintained by deviations from the method now followed.

The annulment or cancellation of these traditional procedures and the substitution therefor of a plan which interposes a third party between the responsible dentist and the patient is one issue around which the majority of the profession break with those who advocate socializing health service. It is still believed that the essence of professional endeavor is quality service, not profit. For service to be most effective, the practitioner must be permitted self-direction in his work. Initiative and ability are essential to progress, but, to be of greatest value, they must be self-exercised. It is most desirable to give individual opportunity and free scope to step out and find new ways of progress and achievement. A third person may or may not be interested in preserving health values or in professional progress, even though the entry may be made on a nonprofit or on a profit basis. The contract agent, an insurance company, a hospital association, a clinic, an industrial concern and the federal and state governments are the principal entities that are denominated as a third party.

Such interposition takes on the marks of an attempt to break down private practice. One surmises that the introduction of an outsider contemplates a division in office management, or a substitution for the management, and perhaps also for a part of its professional direction. No suggestions have been publicized relative to any needed or desirable changes in standards of work or regarding quality, but solicitous inquiries are made relative to the asserted inadequate distribution of service to all those in need and also concerning the amount of the payment for professional service in general.

In other words, the question of the "impossibility" of adequate compensation of dentistry for its work as now rendered and distributed is adroitly raised through such inquiries. To arouse an active community demand for free health care, it is pointed out that the cost of dental services could be reduced appreciably if the fixed overhead, now admittedly high in the average private office, were decidedly lowered; that the cost of dental care could be further reduced by combining private practices to avoid duplication of much equipment, and by the great reduction in the total amount of capital necessary for the installation of the numerous private offices as compared to the capital investment necessary for the institutional or dispensary-type offices, etc.

These statements are misleading and the picture is only a profile. Furthermore, other essentials in such comparisons are omitted. Capital investment is an important consideration and overhead expenses, such as rentals, which approximate 18 per cent of gross production in many offices, are also in need of adjustment downward. To render dental service only on the basis of extended distribution, and on volume, thereby lessening regard for quality and thoroughness, is, of course, inconceivably corrupt and un-

professional. From a sociologic or a financial standpoint, the cost of proper individual or community dental care should not be "absorbed" by dentists any more than the cost of feeding undernourished children should be borne by school teachers, or the burden of proper housing be held a responsibility of architects.

The profession does not desire to utilize a screen of traditional methods or ideals for the solution of practical problems which relate to either larger distribution of service or payment possibilities. The community has been afforded a coordinated, a progressive and a constructive system of dental health care. It seems unsuitable, even in consideration of rapid social changes, to discard certain established patterns which have proved valuable in the dispensing and in the distribution of dental service. Changes in these work models, or suggestions to relinquish adequate and proved methods of practice procedures, are naturally opposed, especially if they are advocated by or made through pressure from outside forces. If there are indications that adjustment and changes of methods are needed, they should originate in and be sponsored by the profession. Otherwise, they will be ineffectual.

The assertion that it is an obligation to extend facilities so that groups classified as "in the low scale of wages" may be adequately served is sounded frequently. Thus, fixed fees, per capita fees, low fees, yearly contracts and fixed salaries are proposed as regulatory measures in this connection. At the present time, there are offices using, or planning to use, one or more of these innovations in practice methods for the purpose of bringing income back to normal or average. How far the trend will carry from this time forward is only conjecture. If there is competition in our work, continued increase in the use of all or part of the forms mentioned will mean that the private office practice volume may be hampered thereby.

Adequate dental care for the poor or for those in "the low scale of wages" is not exactly a recent social demand. Literature reports one such practice in London, England, in 1912—twenty-two years ago. This practice was conducted for patients who were too poor to pay private practitioners. Good practitioners discontinued their identity with the "clinic" and the work performed became unsatisfactory. The practice collapsed after eighteen months, because of internal management dissensions and the fact that patients refused to be stereotyped as poor.

Organization of institutional health center or group practice is undertaken with the belief that the overhead expenses for all types of dental operations will thereby be considerably reduced and, in turn, patients will be benefited financially. There are types of group practices wherein success is attained in both the professional and the management phases, but, so far, the failures appear to be in greater proportion. It is not the point of the discussion to dwell on management problems. It is only intended to call attention to the trend of thought, both from the sociologic and the political standpoint, relative to future policies in the conduct of community dental care. I for one am not disconcerted over prospects of "defeatism" in private practice methods; nor is it my belief that private practice has been or eventually will be broken down. Neither is it intended to disapprove of efforts made to care for those in dire need of dental service during these days of economic stringency. Dental organizations conceive it as a duty to promote every proposal to relieve distress. But it is believed that these desirable ends need not be accomplished by provoking any violent changes in our system

or by the introduction of methods which counter long-established economic order. Methods of a revolutionary character decrease popular confidence, a fact not to be lightly regarded. Moreover, to concede to any outside force a right to revise or supervise our professional activities or impose conditions which will make of us only trained technicians means the establishment of a most destructive policy. It would be unfortunate to operate under a system which could or would reduce the science of dentistry to an industrial plane—with numbers for the patients and, perhaps, numbers for the dentists.

It is of interest and importance to recognize the trends of thought relative to the possibility of our being forced to reorganize and broaden our efforts to conform, in certain respects, to growing public demands for greater community health care, perhaps at public expense. It was a public demand for emergency work that caused the famous circular No. 7 to be issued by Mr. Harry Hopkins, director of National Unemployment Relief, in which organized dentistry was requested to perform dental operations on a contract basis. This is probably the first time in the history of our nation that the dental societies were called on to enter into a contract with the government whereby its members would render health service upon a fixed fee basis. This is a new function and a new experience, requiring adaptation to a situation which has never before existed on a national scale. The plan of circular No. 7 is based upon the principle that medical and dental care of indigents is a community responsibility. According to a recent survey by Phillips, eight state dental societies have not accepted the dictum of community responsibility for dental care and frankly announce their fear of state medicine and the effect of a low fee schedule upon the future of the profession. This call made by the government is the entry of a third party with unlimited powers, which, in turn, practically removes the possibility of debate on the part of the profession.

Mr. Pierce Williams, of the Bureau of Economic Research, expresses the opinion "that the medical and dental care of indigents through governmental and professional cooperation would develop a pattern of action that might be used in plans for the care of the working class groups."

Theodore Peter Swanish, Ph.D., writes relative to this consolidation of positions as follows: "First they offer services to the poor, then to the moderately well-to-do, then to everybody, and they may yet end up by having bills passed to make it compulsory for every one to go to a state clinic."

Herbert E. Phillips expresses the opinion that once this method of health care gets under way, it will be difficult to reduce the benefits thus enjoyed, but it would not be illegal to enlarge such benefits.

Social workers are advocating methods to provide health insurance by commercial insurance carriers, with no mention of consultation with the organized professions. Wisconsin and California state legislative and medical committees are said to be preparing compulsory health insurance bills, including dental care. The New York state dental society committee appointed to study health insurance gives out the information that a compulsory health insurance bill including dental care will be again presented to the New York Legislature at its next session. This bill, according to the report, makes no provision for direction or control of the service by the dental profession. There are many other pertinent examples of legislative prospective enactments which will, or

may at least, drastically affect dentistry.

The reason for citing these trends in legislative movements is to suggest a need that the profession be alert, if necessary, to remove the impression that it will not fight to retain its rights and earned privileges; to resume our responsibility and participation in governmental affairs; to maintain respect for our organizations under whose guidance our models of practice procedures are designated and controlled. There ought at least be given us the privilege of representation in conference when intimate concerns of the whole dental membership are more or less at stake. If there is open criticism, the profession should hear it, to profit by it, and to modify its own policies if it seems best to do so. The entry of the third party into our professional responsibilities or management may have a decided effect on future private practice, especially that part of private practice which relates to professional reward and to payment. Dentistry and medicine appear to be the common vehicles for experiment in social economy.

After all, income and what it will bring does not exhaust the real interest in our work. Our profession does not believe or advocate that there should be a code that has only the financial "in-look" for ourselves. Private dental practice is a free competitive system and is, of course, opposed to a monopolistic practice which is inherent in the company, lay-managed, collective-ownership and group plans. Private practice does not put a veto on further professional growth, nor does it lessen or distribute professional responsibilities. It does not place compulsory limitations on professional endeavors, all of which are quite possible in any other method of practice mentioned.

The dental and medical professions are to a very great degree dependent on public opinion and they are also amenable to public control. As we produce in order to distribute, it is of the utmost importance to consider the opinion of those to whom service is supplied. If acknowledgment were ever indicated, it could justifiably be stated that all dentists entered the vocation to earn a living—not to demonstrate self-denial or abnegation. One and the same individual may be conscientiously actuated by both commensurate financial income and by the sincerest desire to exercise professional abilities in a chosen line of service. In this respect, maintaining our practices to meet shifting social changes does not, of course, mean starting all over again. Many of us will perforce be obliged to be more systematic than heretofore. It may be necessary to acquire advancement in operative and laboratory technic, and particularly a better training in sound business principles as applied to our office management. Positive indications for a reorganization of our efforts will be gradual because they cannot be suddenly conceived. Corrective changes and adjustments in practice methods to correspond with new social and economic conditions will be accomplished by proper tests in actual office practice. New problems brought on by developing civilization make continuous study necessary. In addition to our professional interests, we may be forced to step beyond the limits within which we are actually working. This means that we are to recognize wider social obligations and perform them with the interest which the closer office obligations have always received.

It is the concern of dental organizations, national and state, and of their individual memberships to maintain dentistry also as a means of a livelihood comparable and equal to that afforded by any other learned profession.

# USE OF NUPERCAINE FOR DENTAL ANESTHESIA

By BERNARD I. RABIN, D.D.S., Chicago, Ill.

ANESTHESIA produced by the injection of solutions of quinine salts, first pointed out by Thibault, is characterized by unusually long duration. The chemically related hydrocupreine derivatives cause a similar prolonged sensitivity; indeed, vuzin (iso-octyl-hydrocupreine) is said to bring about anesthesia persisting for eight days. Unfortunately, as all of these compounds lead to more or less severe local tissue damage, their routine clinical employment is impracticable. The synthesis of alpha-butyl-oxy-cinchoninic acid diethyl-ethylene-diamide hydrochloride (known commercially in this country as nupercaine) by Miescher was a distinct advance, because while this substance does not cause local injury when used in appropriate anesthetic concentrations, its effect is much more persistent than that of other local anesthetics in common use.

Nupercaine occurs in the form of a crystalline powder, which is readily soluble in water. Its solutions may be heated in an autoclave under 15 pounds pressure or repeatedly boiled without any decomposition of the salt occurring, if the $p_H$ is slightly on the acid side of neutrality (6 to 6.5). Even slight alkalinity will dissociate the insoluble base, which appears in the form of slender crystals; the solution losing in anesthetic strength, as noted by Lotheisen,[1] who failed to observe the precaution of keeping his solutions in porcelain or nonsoluble (Jena or pyrex) glass containers.

The initial effect of nupercaine is to cause a relaxation of the blood vessels. To overcome this, one may add epinephrine, which not only lessens bleeding but also decreases the toxicity of nupercaine.[2] As pointed out by Main and Trapozzano,[3] good anesthesia may be obtained without the addition of epinephrine, a point of some importance when one has to deal with patients suffering from hypertension or unduly sensitive to epinephrine.

Naturally, the toxicity of any new local anesthetic is a matter of prime importance. By animal experimentation, it has been determined that the absolute toxicity of nupercaine is fully as great as that of cocaine, but the extremely high anesthetic efficiency of the drug would seem to render the relative toxicity comparatively low. Thus, Main and Trapozzano[3] estimate that nupercaine is about twenty-two times more toxic for dogs than is procaine; but Gessner[4] finds that, by the wheal test on man, nupercaine is twenty-five times more actively anesthetic than procaine, and thus, in concentrations of similar anesthetic potency, one would assume that the toxicity of these two drugs is essentially the same, as judged by animal experiment. It should be borne

1. Lotheisen, Hofrat: Wien. klin. Wchnschr., 42:820 (June 13) 1929.

2. Uhlmann, F.: Arch. Int. de Pharmacodyn. et de Therapie, 36:253, 1929.

3. Main, R. J., and Trapozzano, V. R.: J. D. Res., 12:919 (Dec.) 1932.

4. Gessner, Otto: Arch. f. exper. Path. u. Pharmakol., 168:569, 1932.

in mind that experiments of this nature do not enable us to draw final conclusions as to the relative toxicity of the drugs, this being possible only after extended clinical trial. To date, a survey of all available literature fails to reveal any report of a fatality following the use of nupercaine in dentistry, although fatalities have occurred after employment of the drug in other fields.

The efficacy of nupercaine after either surface application or injection, coupled with the unusual persistence of its effect, has led to extensive trial of the drug in the fields of general surgery and rhinolaryngology. Reports on its employment in dentistry have not been so numerous. Dobkowsky[5] finds that a 0.25 per cent solution of nupercaine is equivalent in anesthetic strength to a 4 per cent solution of procaine hydrochloride. He is of the opinion that 0.2 per cent nupercaine should be used for infiltration anesthesia and 0.25 per cent for nerve-blocking in dentistry. For surface anesthesia in the mouth, he used 3 per cent nupercaine. He believes that nupercaine is a satisfactory dental anesthetic, but that additional observations should be made before final conclusions are drawn. Grabner[6] reports that, using a solution of 1:500 nupercaine in saline with 0.01 mg. of epinephrine per cubic centimeter, he achieved successful plexus anesthesia in forty-two of forty-nine cases, with only one case showing any untoward effects. He does not mention what he thought to be the cause of the untoward reaction in this case. Using the same strength solution, he accomplished successful anesthesia in twenty of twenty-three cases of conduction anesthesia. He is of the opinion that when the amount of epinephrine in the solution is very small and the injection is made too rapidly, the anesthetic is carried away from the field quickly. This, he believes, is due to the failure of the vessels in the area to contract. He also reports that with a 1:2,000 solution of nupercaine containing no epinephrine, little or no anesthesia was accomplished. In a few cases wherein the extraction could be carried out after the use of this solution, bleeding was pronounced. Also reported by him is the fact that extractions were performed on three patients in whom procaine was contraindicated owing to organic heart disease. These patients underwent extraction under nupercaine anesthesia without any difficulty, there being merely a slight increase in pulse rate. Later, he reports 1,029 cases in which the drug was used over a period of two years. Seventeen cases showed minor toxic manifestations; an incidence no higher than he has observed after employment of procaine. The long duration of the nupercaine anesthesia is, he feels, responsible

TABLE 1.—EXPERIMENTAL DATA*

| Type of Injection | Longest Time of Onset | Shortest Time of Onset | Average Time of Onset |
|---|---|---|---|
| Infiltration | 5 minutes | 1 minute | 1 minute 40 seconds |
| Mandibular | 15 minutes | 5 minutes 30 seconds | 9 minutes 42 seconds |
| Tuberosity | 3 minutes 30 seconds | 1 minute 50 seconds | 2 minutes 20 seconds |

*Solution: nupercaine, 1:500; epinephrine, 1:100,000.

5. Dobkowsky, Theodor: Zahnärztl. Rund., 39 (May) 1930.

6. Grabner, Alois: Ztschr. f. Stomatol., 28: 268, 1930; 30:1504, 1932.

for the complete absence of postoperative pain. Elzner[7] was successful in using nupercaine topically in 2 to 3 per cent solution and obtained good results with a 0.2 per cent solution by infiltration and for nerve blocking. Fischer[8] used a 0.3 per cent nupercaine solution for infiltration and nerve block. He comments unfavorably on the slow onset of anesthesia (up to ninety minutes in some cases) and thinks that the prolonged loss of sensibility after mandibular injection is a drawback. Szepelski[9] reports that, using a 1:500 solution of nupercaine with 0.00002 mg. of epinephrine per 2.3 c.c., the onset of anesthesia was slower than with procaine. (The strength of the procaine solution is not mentioned by him.) He states that an average of ten minutes was required to attain surgical anesthesia after infiltration and fifteen minutes for conduction. He reports that the average duration of anesthesia in his cases was from nine to fourteen hours. The maximum dose used by him was 0.0248 gm. of pure nupercaine. None of his cases were complicated by untoward effects of the anesthetic agent, nor did he have any postinjection pain. Müller,[10] using 0.2 and 0.3 per cent nupercaine, found that anesthesia set in within five minutes and was satisfactory and prolonged. Deyton and his associates[11] used solutions of nupercaine varying from a 1:1,000 nupercaine content and a 1:48,000 epinephrine content, to a 1:500 nupercaine content and a 1:16,000 epinephrine content. Their report states that only 53.4 per cent of the patients anesthetized with the former concentration had satisfactory anesthesia. It was found necessary to increase the strength of the solution to the latter concentration, after which satisfactory anesthesia was obtained in about 95 per cent of cases. They also stated that uncontrollable bleeding occurred with the weaker solution and caused quite a little trouble. Apparently, they mean that the difficulty mentioned was due to the fact that blood covered the field, causing poor vision. Using the 1:500 nupercaine and 1:100,000 epinephrine solution, we did notice a slight increase in bleeding during operations as compared to the bleeding when

TABLE 2.—EXPERIMENTAL DATA*

| Type of Injection | Satisfactory | Unsatisfactory | Percentage Satisfactory | Percentage Unsatisfactory | Untoward Reactions† | Total |
|---|---|---|---|---|---|---|
| Infiltration | 45 | 0 | 100.0 | 0 | 0 | 45 |
| Mandibular | 38 | 2 | 95.9 | 4.10 | 1 | 40 |
| Tuberosity | 15 | 0 | 100.0 | 0 | 0 | 15 |
| Total | 98 | 2 | 98.6 | 1.38 | 1 | 100 |

*Solution: nupercaine, 1:500; epinephrine, 1:100,000.

†The untoward reaction in this single case was probably due to fright and malnutrition.

7. Elzner, W.: Inaug. Dissert., Friedrich, Wilhelms U. (Bonn), Bonn, Germany: Paul Kubens, 1931.

8. Fischer, E. H.: Zahnärztl. Rund., 41 (Sept.-Oct.) 1932.

9. Szepelski, Konrad: Deutsche Monatsschr. f. Zahnheilk., No. 17, p. 786, 1932.

10. Müller, Karl: Schweiz. Monatsschr. f. Zahnheilk. 43, No. 7, 1933.

11. Deyton, C. D.; Wilson, J. W., and Zaus, E. A.: D. Cosmos, 74:857 (Sept.) 1932.

using a 2 per cent procaine solution containing 1:50,000 supranol, but at no time was it necessary to cease working and employ a solution of higher epinephrine content to continue the operation. It is interesting to note that the most satisfactory results were obtained by Deyton *et al.* in cases wherein the mental injection was used. According to their charts, this type of injection gave the greatest percentage of favorable anesthesia regardless of the strength of the solution used. Main and Trapozzano[3] found, in a group of students presumably more intelligent than clinic patients, that conduction anesthesia after the use of 0.2 per cent nupercaine persisted more than three times as long, on the average, than after 2 per cent procaine hydrochloride. Nupercaine, 0.2 per cent, was effective both for infiltration and for nerve block, the onset of anesthesia being as rapid as after the use of procaine hydrochloride. Barkann,[12] writing on the use of nupercaine topically, states that rendering the 2 per cent solution slightly alkaline prior to application enhances its anesthetic activity markedly. We have found that this procedure is not absolutely necessary.

Our findings differ from those of Deyton *et al.*, but corroborate those of Grabner. The solution used by us contained nupercaine 1:500 and epinephrine 1:100,000. It was supplied in 2 c.c. ampules. In all injections, one minute was taken to inject 2 c.c. of the solution used. The time interval between the injection and the onset of surgical anesthesia was calculated from the time of withdrawal of the needle to the time when deep probing with a sharp instrument caused no pain. The operations were performed immediately after and included all types of extractions and minor oral operations. About 40 per cent of the patients were colored, the remainder white. The difference in race did not make any apparent difference in the success or failure of the anesthesia. No preoperative medication was used on any case.

It is difficult for us to make a statement as to the duration of anesthesia as all of the patients left immediately after completion of the operation. Many returned for further treatment, but they gave only vague statements. From one patient, whom we believed capable of telling what he really felt, we learned that the peculiar sensation manifested by a mandibular injection lasted for twelve hours. The fact that the sensation lasted for this length of time does not mean that surgical anesthesia was present. None of the patients who returned complained of any postinjection pain. Results are summarized in Tables 1 and 2.

## SUMMARY

1. Nupercaine gives satisfactory plexus and conduction anesthesia which remains over a long period of time.

2. Used in correct strengths, it is nontoxic and will not cause sloughing of tissue or any postinjection pain.

3. It may be used topically to produce anesthesia before needle punctures, in periodontic work and for any operation in which surface anesthesia is desired.

4. Anesthesia is produced within a reasonable time.

5. Nupercaine may be used with safety where procaine is contraindicated.

6. It is not irritating to the skin of operator or patient.

12. Barkann, Lillian: D. Cosmos, 75:580 (June) 1933.

# HEREDITARY TENDENCIES IN TOOTH FORMATION

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THE oft quoted "rule" that offspring ordinarily receive their hereditary tendencies as to frame from the female parent and their "plumage" from the male is not wholly justified by experience.

As far as tooth formation is concerned, there seem to be certain definite facts that present themselves. Of course, any disease that the mother may have at the time of conception or while she is pregnant is frequently found to have left stigmata in the deciduous teeth of the child and, in case of syphilis, the stigma is carried over to the permanent teeth as well. Probably more cases of latent hereditary syphilis could be diagnosed early if physicians and dentists understood the identification of Moon's or Fournier's tooth, which is a much more frequent finding than the classical Hutchinson's tooth. It would, of course, be necessary also to be able to differentiate this condition from the hypocalcemia that is seen in severe rickets. This is not difficult because the rickets deformity is usually seen in all of the teeth, while the Fournier deformity is limited to the first permanent molars.

There are other anomalies of tooth formation that seem to follow a fairly consistent routine as far as their appearance in members of a given family are concerned.

## FAMILIAL "DOUBLE-TOOTH"

We have observed three families in which a tendency toward double-tooth or a complete union of two deciduous lower incisors has been present in several of the members. The occurrence and transference of this anomaly has followed such a consistent plan as to indicate an established rule. Brief histories of the three families are given.

### CASE REPORT

CASE 1 (Fig. 1).—An 8-months-old baby girl was brought in for examination and treatment of a mild intestinal upset. In the course of the examination, it was found that her lower right first and second incisors united to form one large double tooth. The mother volunteered the information that this was characteristic of the females in her family, and a more detailed history from the mother and grandmother elicited the following information: The grandmother and one sister had had the same deformity. Another sister and two brothers had been free from the condition.

This history seems to be accurate as the mother of these grandparents had been "looking for the defect." No one is sure whether she had it, although her interest seems to indicate that she may have had the condition.

One of the sisters so affected had two daughters and one son. Both daughters had double deciduous teeth and the son was normal as far as tooth development was concerned. The other sister had three daughters and no sons. Two of the daughters had the same condition. The children of the "normal" sister consisted of two sons and one daughter, all free of the defect. The brother had only one son and he too was free of it. Of the grand-

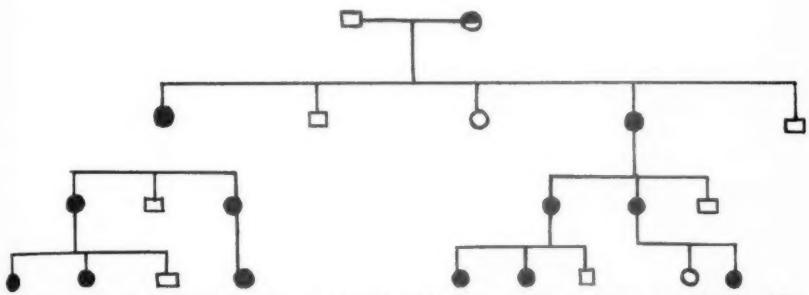

Fig. 1.—Chart showing incidence of "double deciduous tooth" in members of one family. The black circles indicate the members who presented the anomaly. Where offspring are not indicated, none of the children of these parents had the defect. The great grandmother is indicated by a half circle as there is some doubt concerning her history.

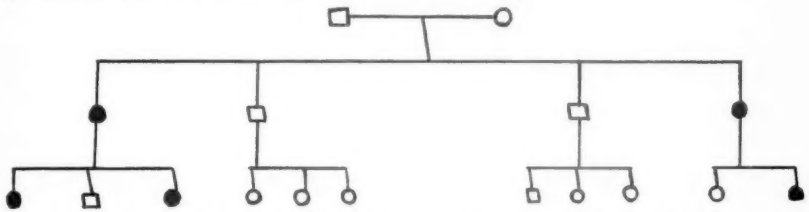

Fig. 2.—Incidence of "double deciduous tooth" in members of one family.

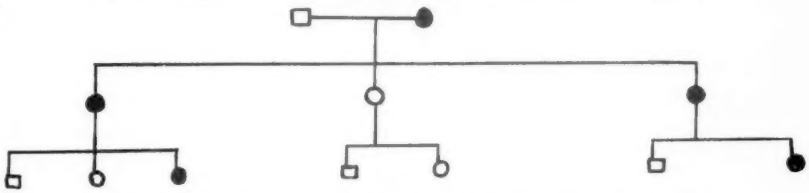

Fig. 3.—Incidence of "double deciduous tooth" in members of one family.

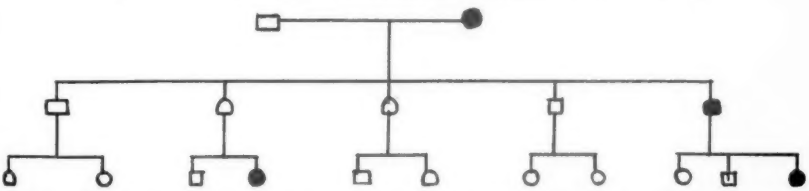

Fig. 4.—Incidence of "transparent tooth" in one family. The black circles indicate the members of the family who presented the transparent enamel-dentin syndrome.

children in this family, there are two daughters and a son by the first child (female). Both girls present the defect. The boy does not. The second daughter had one daughter only (our patient), and she had the same defect.

Three female second cousins of the patient also showed the defect as the chart

(Fig. 1) indicates, while two male second cousins did not present the defect.

None of the permanent teeth in any of the adults of these three families showed any defect. Figures 2 and 3 show how the defect appeared in the other two families.

A study of these charts will show that whenever the condition was transmitted from one generation to the next, it was through a female with the defect to another female. Never, in these three families, was the condition found in a male, nor was it transmitted through a male to another female. Naturally, this series is too small to warrant deductions and is merely offered as evidence of what has been found in one series of cases.

### TRANSPARENT TEETH

Another condition which shows certain hereditary aspects was observed in only one family. This is the anomaly termed transparent enamel. Probably a better term would be "sclerosed transparent" dentin and enamel, a term emphasized by Beust[1] and unquestionably more applicable, as the tooth structure, though permeable to light rays, is sufficiently sclerosed to withstand normal tooth function. This is borne out by the fact that the adults of this family did not show more and probably not so much tooth decay as the average for their ages.

That the condition, in this family at least, is definitely hereditary and not due to some deficiency in the water supply is proved by the fact that the various members live and have been reared in various parts of the United States, and also by the fact that not only the deciduous, but the permanent teeth as well, were affected.

Figure 4 shows the distribution of this peculiarity in three generations of the family. In this family too, the dental anomaly was found only in the females, but it has been transmitted through one unaffected woman to her daughter, although her son did not show the peculiarity. Another mother (of the second generation) had one daughter and one son free from the peculiarity, while the last child, a daughter, had the condition.

Another interesting point in the investigation of this family was that all the affected members were the last children to be born to their parents and all were born after their parents had reached middle age.

### SUMMARY

Case records of four families with dental anomalies are presented. In these four families, the condition was transmitted only to females of the groups and usually was transmitted only through females who were themselves affected, although there was one exception in which an unaffected female transmitted the condition to one of her children.

1. T. B. Beust, Physiologic Changes in the Dentin, J. D. Res., (April) 1931.

# TOXICITY AND EFFICIENCY OF A NEW LOCAL ANESTHETIC*

By LEONARD S. FOSDICK and HAROLD L. HANSEN, Chicago, Ill.

SINCE Einhorn,[1] in 1909, discovered procaine and its various salts, many local anesthetics have been prepared. The object in the preparation has been two-fold: (1) to prepare a local anesthetic that would be better and more nearly ideal than procaine, and (2) to discover if possible some relationship between anesthetic efficiency, toxicity and chemical structure.

Many of the newer anesthetics are good for many types of operations and, in some respects, are probably better than procaine. The latter is still the most widely used local anesthetic. In regard to the relationship between anesthetic efficiency, toxicity and chemical structure, much work has been done but little has been accomplished.

In view of the fact that sulphur occupies its characteristic position below oxygen in the periodic table and hence in many respects is similar to oxygen, we[2] thought it would be interesting to prepare and study compounds analogous to the procaine series with the ester oxygen replaced by a sulphur. As expected, these compounds all have marked anesthetic properties, both for topical anesthesia and for injection when soluble.

As in the case of the procaine series, all of the esters prepared, with the exception of the salts of the alkamine ester, were insoluble in water and could not be conveniently studied. The following work is an investigation of the anesthetic efficiency and toxicity of thiocaine hydrochloride (diethylaminoethyl p-amino thiobenzoate hydrochloride), a salt of the only alkamine ester as yet prepared.

## EXPERIMENTAL PROCEDURE

The anesthetic efficiency was determined by the gold fish method,[3] the "wheal test" and the rabbit's cornea method.

For the gold fish method, fish of the common variety, weighing from 2 to 4 gm., were used. They were kept in tanks at about 20 C. with no sudden change in temperature, and, when ready for use, were transferred by means of a cloth net to the anesthetic solution, which was of the same temperature. The fish were used only once to eliminate the possibility of their developing tolerance for the drug.

Three gold fish were transferred to a 600 c.c. beaker containing about 250 c.c. of the solution to be used, and the time required to anesthetize them was noted by the usual method of pressure applied to the tail by means of a glass stirring rod. When the fish did not respond to pressure, it was considered that anesthesia

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 11, 1933.

1. Einhorn and Uhlfelder: Ann., 371: 131, 1909.

2. Hansen, H. L., and Fosdick, L. S.: J. Am. Chem. Soc., 55:2872, 1933.

3. Adams et al.: J. Am. Chem. Soc., 48:6, 1926.

was complete and the time was noted with a stop watch.

The solutions used were procaine hydrochloride 1:500 and thiocaine hydrochloride 1:500 and 1:1000. The time of anesthesia for procaine hydrochloride as obtained by Dailey and co-workers[4] and by us was checked and found to be fourteen minutes.

The procedure of the "wheal test" is as follows: A sterile procaine solution in isotonic salt was made up to a 2 per cent strength. Sterile thiocaine hydrochloride solutions were made up in isotonic salt of the concentrations of 1, 0.5 and 0.2 per cent. A wheal was produced on the arm by injecting 0.3 c.c. of each solution subcutaneously. The wheal was then pricked from time to time with a sharp probe and when pain could be detected, it was considered that the anesthesia was over.

TABLE 1.—RESULTS OF GOLD FISH EXPERIMENT WITH THIOCAINE HYDROCHLORIDE

| Goldfish | Time for Anesthesia Min. | Sec. | Concentration | $P_H$ |
|---|---|---|---|---|
| 1 | 2 | 10 | 1:500 | 6.5 |
| 2 | 2 | 10 | 1:500 | 6.5 |
| 3 | 2 | 10 | 1:500 | 6.5 |
| 4 | 2 | | 1:500 | 6.5 |
| 5 | 2 | | 1:500 | 6.5 |
| 6 | 2 | | 1:500 | 6.5 |
| 7 | 2 | 21 | 1:500 | 6.5 |
| 8 | 2 | 21 | 1:500 | 6.5 |
| 9 | 2 | 21 | 1:500 | 6.5 |
| 10 | 3 | 5 | 1:1,000 | 6.4 |
| 11 | 3 | 5 | 1:1,000 | 6.4 |
| 12 | 3 | 5 | 1:1,000 | 6.4 |
| 13 | 3 | 5 | 1:1,000 | 6.4 |
| 14 | 4 | | 1:1,000 | 6.4 |
| 15 | 5 | | 1:1,000 | 6.4 |

Average for thiocaine hydrochloride, 1:500, 2 minutes 10 seconds.
Average for thiocaine hydrochloride, 1:1,000, 3 minutes 48 seconds.
Average for procaine hydrochloride, 1:500, 14 minutes.

Healthy rabbits were procured and a few drops of anesthetic solution was dropped in the conjunctival sac in each eye. The solutions used were 1 per cent cocaine hydrochloride and 1 per cent thiocaine hydrochloride. Cocaine hydrochloride solution was placed in one eye of the rabbit, while thiocaine hydrochloride solution was placed in the other eye. Time for the onset of anesthesia as well as the duration was determined by brushing the eye with a stiff bristle and noting the presence or absence of the winking reflex.

TABLE 2.—RESULTS OF WHEAL TEST; DURATION OF ANESTHESIA

| | Procaine | | Thiocaine | | |
|---|---|---|---|---|---|
| | 2 Per Cent | 1 Per Cent | 0.5 Per Cent | | 0.2 Per Cent |
| Patient | Min. | Min. | Min. | Sec. | Min. |
| 1 | 28 | 33 | 31 | 5 | — |
| 2 | 33 | 23* | 30 | | — |
| 3 | 38 | 43 | 37 | | 31 |
| 4 | 25 | 37 | 42 | | 32 |
| 5 | 37 | 43 | 30 | | 29 |
| 6 | 25 | 34 | 32 | | 21 |
| Average | 31 | 38 | 34 | | 28 |

*Poor wheal.

TABLE 3.—TESTS WITH RABBIT'S CORNEA

| | Thiocaine 1 Per Cent | | | Cocaine 1 Per Cent | | |
|---|---|---|---|---|---|---|
| | Onset | | Duration | Onset | | Duration |
| Rabbit | Min. | Sec. | Min. | Min. | Sec. | Min. |
| 1 | 1 | | 20 | 1 | 30 | 14 |
| 2 | | 55 | 18 | 1 | 40 | 11 |
| 3 | | 40 | 28 | 2 | 20 | 25 |
| 4 | | 45 | 26 | 2 | 15 | 22 |
| 5 | 1 | | 25 | | | |
| Average | | 52 | 23 | 1 | 55 | 18 |

TABLE 4.—TOXICITY TESTS WITH THIOCAINE HYDROCHLORIDE

| Mg.-Kg. | No. Mice Used | Dead | Mortality Per Cent |
|---|---|---|---|
| 640 | 5 | 5 | 100 |
| 400 | 6 | 5 | 83 |
| 320 | 10 | 8 | 80 |
| 275 | 10 | 5 | 50 |
| 225 | 10 | 3 | 30 |
| 200 | 10 | 3 | 30 |
| 175 | 10 | 0 | 0 |

The toxicity was determined by the use of white mice according to the

4. Dailey, H. T., and Benedict, H. C.: D. Cosmos, 71:704 (July) 1929.

method of Schmitz and Loevenhart,[5] with the modification of Dailey.[4]

Sterile technic was employed as much as such animal work permits. The work of Dailey was first checked in respect to procaine and was found to be satisfactory. Fresh solutions of thiocaine hydrochloride were made up and the concentrations varied by dilution with distilled water. The concentrations were adjusted so that each mouse received approximately the same volume of fluid, not more than 1 c.c. being injected in any mouse.

## RESULTS

The results of the gold fish experiments are summarized in Table I.

The results for the wheal test are summarized in Table 2.

The results obtained by the rabbit's cornea are shown in Table 3.

## TOXICITY

The mice were weighed and the calculated amount of drug was injected, the results being shown in Table 4.

## COMMENT

The foregoing results show clearly that the actual anesthetic efficiency of the drug varies somewhat with the method used for its determination. There is never such a wide variation that it would be impossible to tell the relative efficiency. It follows from the foregoing that the anesthetic efficiency of thiocaine hydrochloride is from four to six times that of procaine hydrochloride when used for injection and approximately twice as powerful as that of cocaine when used as a topical anesthetic. The toxicity is between two and three times as great as that of procaine, depending on whether it is classified on the basis of minimum lethal doses or per cent mortality and is approximately one half as toxic as cocaine on either basis.

The results that we have obtained were checked in the clinic on various types of injections with satisfactory results. In all clinical cases, a 0.5 per cent solution was used. The anesthesia was obtained in two minutes and had a duration of about that of procaine. The topical effect has been observed in the eye clinic with favorable results.

Borate of thiocaine is now being studied and other alkamine esters of the same type are now being prepared.

## CONCLUSION

1. The toxicity and anesthetic efficiency of thiocaine hydrochloride has been determined.

2. The substitution of sulphur for oxygen in an ester linkage produced a compound more toxic and with more anesthetic efficiency.

5. Schmitz, H. L., and Loevenhart, A. S.: J. Pharm. Exper. Ther., 24:159, 167 (Sept) 1924.

# IMPRACTICABILITY OF PRESENT-DAY AMALGAM TECHNIC

By WILLIAM E. HARPER, D.D.S., Chicago, Ill.

THE need for making the most nearly perfect amalgam fillings possible is generally unrecognized and untaught. This fact explains the inconsistencies of amalgam work.

In proof that amalgam technic as at present taught must be abandoned, I present the following report:

During the past twenty-five years, in all of my clinics before dental societies and study groups, where time and conditions would permit, I have requested that those especially interested come prepared to make duplicate test fillings in simple, round and mesioclusal test cavities, each using his own high-grade dental alloy, instruments and mortar and pestle, one group of tests to be made with the amalgam technic at present taught, as in every day practice, a second group of test fillings (following an hour's demonstrative clinic) to be made with a modernized amalgam technic such as I describe and demonstrate.

One of the surrounding cavity walls of the mesioclusal test cavities was made removable to permit examination with the naked eye of the character of the adaptation in its line and point angles, after which the fillings were tested for less conspicuous leaks by the application of air pressure along the inner depths of the cavity walls.

Irrespective of the fact that the United States Bureau of Standards approved, nonshrinking dental alloys were generally used, over 70 per cent of the fillings made leaked when exposed to low air pressure; and the air bubbles continued to rise as long as the air pressure remained.

The average of the results attained by the use of a modernized amalgam technic, which I demonstrate, was 80 per cent of nonleaking fillings, and these, with comparatively few exceptions, remained permanently nonleaking.

This comparative test work has been so extensive and consistent in its results that, I confidently state, a duplication by other investigators will verify the results which I report.

The now discarded, low silver amalgams were very weak under mouth stresses and shrank dangerously; and it was assumed that, with the correction of these physical faults, our amalgam difficulties would be eliminated.

But in changing the dental alloy formula from a low to a high silver content, we developed unexpected physical and operating differences in the amalgams made that require entirely different manipulative management; differences that my profession and academic amalgam authorities seem to have overlooked.

The low silver amalgams are easy to amalgamate. They develop a smooth, easy flowing, slow hardening plasticity; which provides abundant operating time for the application of a thorough condensing technic. The high silver amalgams behave entirely differently. They are difficult to amalgamate, unless mercury is used in liberal excess. They

quickly develop a harsh working plasticity under our present taught amalgam technic. The insufficiency and short period of their plasticity causes the amalgam to drag and crack as it spreads from under the packing thrusts, developing structural voids in cavity angles and against cavity walls and margins. The frequency and extent of the structural voids cannot, within the cavity, be revealed except by examination with the naked eye or by the air pressure test for adaptation.

G. V. Black developed the formula range of our dependably strong, nonshrinking dental alloys, but he did not continue his amalgam researches long enough to recognize the pronounced tendency of the high silver dental amalgams to form structural voids and defects. The incompleteness of Dr. Black's test methods, micrometer measurements for shrinkage and expansion only, explains why we have so long continued in the mismanagement of modern high silver dental amalgams.

There are two fundamentals of successful amalgam management, neither one of which can be neglected or compromised in the use of high silver dental amalgams: (1) the use of as thin and smooth flowing an amalgam as it is possible to develop and maintain and manipulate, and (2) the most nearly uniformly applied condensing technic that it is possible to apply successfully under operating conditions in the mouth, a uniformity of condensation that is impossible of successful application with our present taught, haphazardly applied packing technic used under working conditions in the mouth.

An excess of mercury is as necessary throughout the condensation of the amalgam as it is in the mixing. The use of an excess of mercury facilitates amalgamation and aids in the development of the most favorable working plasticity.

The retention of all of the excess mercury used in the mixing is the only means by which we can retard and control the setting sufficiently long to permit the application of a thorough condensing technic. The retention of the excess of mercury is the only means by which we can maintain nonleaking adaptability of the amalgam during a condensing period of from seven to ten minutes.

When all of these vitally important operating purposes have been served, we may as completely express this dangerous excess of mercury in the final condensation of each piece of amalgam placed as when we attempt to do it by pinching it out immediately after the mixing and before it has served its operating purposes.

The results of our amalgam work are not so inconsistent as the technic with which our amalgam fillings are made. Some of the variables I quote from my research records:

In the filling of simple, round cavities 8 mm. in diameter by 2.5 mm. deep, the graph records the number of thrusts and the weight of each thrust. The number of thrusts applied varies from 100 to 700, the weight of the thrusts varies from one-half to 4 pounds, with an average of about 2 pounds applied by operators of average skill. These variables applied haphazardly without reference to the size of the plugger should be sufficient to condemn our present taught amalgam technic.

The following outline of a modernized amalgam technic is presented as a proved, practical and uniformly dependable amalgam procedure in the use of all high grade dental amalgams.

The slight differences in the physical perfection of the high-grade dental alloy used guarantees no superior merit in the dental amalgam it makes.

The important physical qualities of permanent adaptability to cavity walls and margins, strength and stability, without leakage, are one and all dependent on the care and skill of the dentist who mixes, places and condenses the amalgam.

In the technical procedure involved, the dentist makes out of the dental alloy an entirely different alloy (a eutectic mixture alloy) the physical perfection of which is entirely dependent on the care and skill of the dentist who mixes, places and condenses it. The dentist alone can guarantee physical perfection, not the dental alloy used.

A smooth flowing, practical working, microscopically fine grained amalgam, during its condensation, has by far the most valuable physical attribute, adaptable plasticity, about which the dentist should be concerned in the selection of a dental alloy.

A dental alloy may show no setting shrinkage, but if it is not plastically adaptable to cavity angles and against cavity walls and margins, it will make a leaking filling.

Moderate shrinkage in a microscopically adaptable amalgam is not necessarily dangerous to nonleaking adaptation. Moderate shrinkage is easily compensated for by the elasticity of the tooth structure, which is always developed by any condensing technic that is sufficiently thorough to remove the dangerous excess of mercury, without which no amalgam is dependable.

The only important physical difference between our properly made high-grade dental alloys that is known to me is that some will make amalgam that will develop more favorable operating qualities, and, as a result, such amalgams will be found much easier to adapt without leakage to cavity angles and against cavity walls and margins. Some reputably made high-grade dental alloys will make amalgams that are comparatively easy to adapt without leakage to cavity walls, and some make nonshrinking amalgams that are very difficult to adapt without leakage to cavity walls.

Dental alloys are made quick and medium setting—which one should I use?

Because of their greater plasticity and slower setting qualities, the medium setting dental alloys are much easier to manipulate successfully, and as a result are more popular. These alloys may be considered as generally dependable as the quick setting, but because of the great loss of time incident to their slow hardening, their successful use at the prevailing low fees of from $1 to $3 prohibits their profitable use in any except small, simple, round and pit and fissure cavities.

### PROPORTIONS

Different dental alloys require different proportions. The proportions given by the alloy manufacturer should be followed until, by experience, the operator finds it desirable to modify the proportions to meet his particular operating needs, as based on whether he is a slow or a quick operator, but mercury should always be weighed out in liberal excess, an excess that will make as wet a mix as can be conveniently manipulated.

### MIXING

To date, mortar and hand mixing has proved to be most generally dependable.

When the detailed requirements for mixing amalgam are understood, the process is not difficult, but the time requirements, the means and manner in which it should be done are very exacting.

A properly proportioned mix should be as wet as it can be manipulated into a cavity. From this very plastic mix, no excess of mercury should be expressed after the mixing, as is generally taught

and practiced. Expressing the excess of mercury, after mixing, is the greatest mistake in our amalgam technic as at present taught. It is the commonest cause of the leaks that are shown in the accompanying illustrations.

By retaining in the amalgam mass the excess mercury used in mixing, the plastic workability and adaptability of the quick setting dental amalgams can be prolonged from three to eight minutes; which will permit the average skilled operator to thoroughly condense the amalgam.

As each piece of amalgam to be used is picked up, it should be again kneaded in the hand for from two to four seconds. This will restore its original plasticity, after which some of the excess of mercury may be pinched out. After that is done, the amalgam should never be allowed to stand, but must be immediately condensed. As the filling approaches completion, the excess of mercury may be expressed gradually but increasingly, until, for the finishing of the filling, the amalgam remains just sufficiently plastic to securely unite with the body of the filling.

Fig. 1.—Form of condensing burnishers.

Our present amalgam procedure is so completely in error that it must be abandoned in its entirety. The burnishing technic as a method for the condensation of amalgam has been advocated by other amalgam workers, but none seems to have carried out a line of research sufficiently complete to prove or disprove its worth as a condensing procedure. Our present taught haphazardly applied packing technic is a failure, because it cannot be uniformly applied under conditions presented when the dentist is operating in the mouth.

The burnishing technic applied in one continuous, gradually enlarging circular stroke of uniform condensing pressure, from the center of the filling toward the surrounding cavity walls, guarantees the most nearly uniformly perfect condensing technic at present known. Understandingly applied, this technic assures the most nearly complete removal of the dangerous excess of mercury, wringing the mercury out instead of driving it to and fro and often pocketing it.

It assures the most nearly uniformly perfect adaptation along all cavity walls and margins, eliminating the danger of the leaks that result from overstepping the plugger and assuring the uniform density and strength of the amalgam.

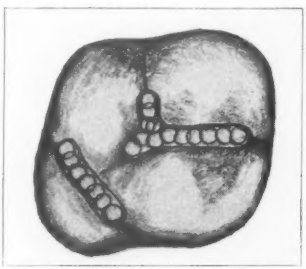

Fig. 2.—Narrow fissure cavities and narrow groove extensions.

The whole principle of prefect amalgam work is microscopically perfect adaptability (plasticity) of the amalgam and uniformity of condensation.

The inference or statement made in advertisement of an alloy that a dental alloy does or can be made to resist the variables of different manipulations is a misrepresentation.

A PROMISING EXPERIMENT

After completion of the mixing and before any of the amalgam is placed in the cavity, I wet the floor and surrounding cavity walls with 95 per cent phenol, without wiping it out, against or on top of which the amalgam is placed and condensed, as described under a modernized amalgam technic.

With this simple addition to the modernized technic, I have made 220 nonleaking fillings, without a single failure, in every form and size of test cavity that I use. The practicability of this experiment I leave to the profession to decide.

Figure 1 illustrates the form of the condensing burnishers used. These burnishers are made in four sizes, 3 mm., 2 mm., 1.5 mm. and 0.9 mm., which will be found to meet condensing needs of every form and size of cavity.

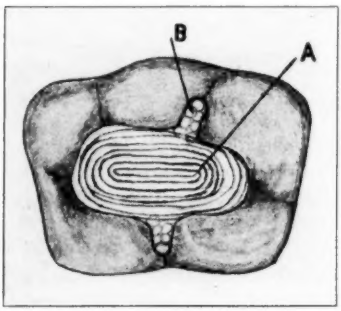


Fig. 3.—Manner of applying burnishing technic in generally round and oval cavities.

Figure 2 shows narrow fissure cavities and narrow groove extensions. These are not successfully condensed by the use of the small burnisher. In such cavities, the burnisher is used as a plugger by stepping in one direction, a little less than the diameter of the burnisher, from one end of the cavity to the other. Overstepping or haphazard movement of the condensing instrument is undependable.

Figure 3 illustrates the manner of applying the burnishing technic in generally round and oval cavities. The first one or two pieces of amalgam placed in a cavity should always be very plastic. After they have been tamped to place, with very light burnishing pressure, we start burnishing at *A*, working in one direction, in gradually enlarging circles, until the surrounding cavity walls are reached, at which point we materially increase our burnishing pressure both vertically and laterally, burnishing with extra thoroughness, where leaks would be dangerous.

The technic described is repeated to the completion of the filling, the burnishing pressure being gradually increased as the plasticity of the amalgam is reduced, as described elsewhere in this presentation. Narrow extensions, *B*, are condensed by using the burnishers as a plugger. The rounded form of the burnisher is more favorable to maximum density of the amalgam than the flat faced amalgam pluggers.

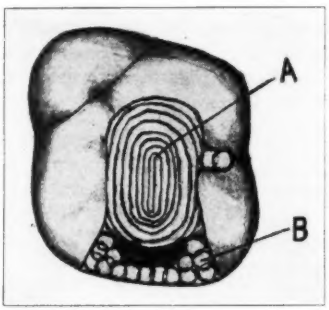


Fig. 4.—Combined condensing technic: burnishing in open occlusal portion of cavity combined with packing in angularities of narrow approximal portion of cavity, where burnishing is not practicable.

Figure 4 illustrates a combined condensing technic, burnishing in the open occlusal portion of the cavity combined

with packing in the angularities of the narrow approximal portion of the cavity, where burnishing is not practicable.

Up to the level of the floor of the dovetail step, the amalgam is condensed by packing, the small burnisher, used as a plugger, stepping from buccal to lingual or lingual to buccal aspect as indicated at *B*. The use of the burnisher as a plugger is confined, as shown, to the matrix, buccal and lingual walls and their line and point angles. It is never employed against the central portion of the cavity of the axial wall where condensing pressure may prove a pulp irritant.

With the amalgam built up to the floor of the dovetail step, we now start to burnish the filling as illustrated at *A*, following each burnishing by the use of the small burnisher as a plugger, as indicated at *B*. The large burnishers will not reach into the acute angularities of the approximal portion of the cavity. The orderly stepping of the small burnisher used as a plugger is indicated at *B*. The large burnishers will not reach into the acute or point angles.

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# PREOPERATIVE AND POSTOPERATIVE CARE OF EXTRACTION CASES*

By HENRY B. CLARK, D.D.S., St. Paul, Minn.

UNTIL rather recently, dentists have not given a great deal of consideration to the preoperative and postoperative phases of extraction cases. Specialization is probably responsible for the institution of better practice along these lines; likewise, the general use of the dental roentgenogram has brought to light much which heretofore remained hidden.

It is to be hoped that, in the near future, among preoperative procedures, the taking of a dental film will always be included. It is likewise to be hoped that, among postoperative procedures, the taking of a film will always be included.

It will at once be seen that the average man, and that includes most of us, will say that these statements are extreme, that preoperative and postoperative roentgenograms are usually unnecessary. A long experience with all types of extraction cases has convinced me that, while many preoperative films indicate that extraction might have been performed without the aid of a preoperative roentgenogram, enough difficulty and disappointment will be avoided to warrant making this procedure routine. In like manner, I am convinced that, regardless of how skilfully or with what care extraction is carried out, and disregarding the fact that a great percentage of postoperative roentgenograms reveal nothing of essential importance, a great enough percentage of films reveal valuable information to make their routine employment a rational procedure.

### CHOICE OF ANESTHETIC

Nitrous oxide is the anesthetic of choice for nearly all extractions, provided they can be performed by an operator skilled and used to operating with this type of

*Read at the Seventy-Fifth Annual Session of the American Dental Association in conjunction with the Chicago Centennial Dental Congress, Aug. 11, 1933.

anesthesia, a well-trained anesthetist and a well-trained assistant. Most dentists must operate with less than these minimum requirements. Therefore, the anesthesia of choice will be a combination of the various forms of local anesthesia. These operators will find the anesthesia limited to the removal of teeth whose peridental membranes are not acutely inflamed, and they will subject their patients to considerable risk if they operate on submerged or impacted teeth whose pericoronal tissues are acutely inflamed.

When nitrous oxide is used, teeth with peridental membranes inflamed and cases in which pericoronitis exists may frequently be handled safely and considerable periods of pain and discomfort be avoided.

### LABORATORY PROCEDURES

Dentists, of course, rarely resort to laboratory procedures preoperatively or postoperatively for extraction cases. There are two procedures that I would recommend for further consideration at this time. When unusual lesions are discovered in the mouth or extraction wounds fail to heal properly with reasonably good care, we are remiss in our duty if we do not advise a Wassermann test.

Likewise, when peculiar sloughing areas are encountered, and especially when accompanied by prostration and excessive fatigue a white blood cell count and differential count should be called for. A peculiarly malignant disease has rather recently made its appearance, and seems to be on the increase. It is variously called agranulocytic angina, neutropenia and pernicious leukopenia. It is estimated to be fatal in about 90 per cent of cases, and no satisfactory treatment is known for it.

In many cases, the first symptoms are noted as an ulcerative condition in the mouth and the extraction of teeth seems peculiarly prone to light up latent cases. The discovery of the presence of this disease through a differential blood count often may not result in any particular advantage to the patient.

First attacks are often fatal, and if not, there is extreme liability of recurrence with fatal outcome in a few months.

It will readily be seen that a diagnosis of neutropenia would be a great protection to a dentist who had been so unfortunate as to remove teeth at the onset of this disease. It might be well to repeat here the admonition so often made before gatherings of this type that all unfamiliar growths and ulcerations in the mouth should be the subject of a careful biopsy with a view of detecting incipient carcinoma.

Time and again teeth are removed which, on superficial observation, seem to be loosened by ordinary dental disease such as alveolar abscess and pyorrhea, but which, in fact, are pushed out of place by malignant growth.

When such teeth are removed without recognition and prompt treatment of existing conditions, valuable time is often lost, and a condition is finally created which results in unnecessarily disfiguring operations or loss of life.

### TOPICAL APPLICATIONS

Topical applications to be made before the insertion of needles for the injection of local anesthetics have been exploited, tried and often discarded. They have a place in the practice of local anesthesia.

Many such applications may be discarded as of little benefit, with the exception of 10 per cent cocaine solution. When it is desired to make an injection painless, the point of insertion of the needle should be dried and swabbed with 10 per cent cocaine. It requires four to five minutes for sufficient absorption to make the drug effective. During the wait-

ing period, it is well to repeat the application.

Members of the profession who have been subjected to local anesthesia have been particularly loud in their praises of this procedure.

### POSTOPERATIVE PAIN FOLLOWING PROCAINE INJECTION

When the subject of postoperative pain following injection of procaine is mentioned, dentists who consider themselves skilful in the use of procaine solutions are prone to declare that postoperative pain is nonexistent after the correct use of such solutions, thereby virtually declaring that postoperative pain does not follow their injections. Patients are peculiarly hesitant about mentioning such pain or they have come to consider it a necessary part of such procedure. At least, it is a fact well known that, in the practice of those who are known to favor nitrous oxide anesthesia, there are patients who constantly state that they will never again submit to local anesthesia because of the postoperative pain. It, therefore, should be routine to administer at the time of injection, a suitable dose of some analgesic, such as acetyl salicylic acid. This will usually protect the patient through the period when postoperative pain usually appears. In addition, every patient subjected to local anesthesia should be provided with a few analgesic tablets for use in the event of postoperative pain.

Attention should be called to the fact that certain persons are sensitized to certain drugs, such as cocaine, coal tar derivatives, quinine and the barbiturates. It is well to inquire, before administering or prescribing these, as to whether the patient can tolerate the remedy in question.

The seriousness of the necessity for such precaution is illustrated by the death of a woman within ten minutes after she had taken a 5-grain tablet of aspirin (acetyl salicylic acid).[1] Among the people who are liable to be susceptible are asthmatics and hay fever sufferers, although many of these can, and do, take the drug.

### PREOPERATIVE MEDICATION FOR NEUROTIC TYPES

At times, dentists experience considerable difficulty in inducing this type of patient to submit to general or local anesthesia. We all are familiar with the type who, after being seated in the dental chair, offer all sorts of unreasonable excuses for not allowing the operation to proceed. Such patients may be handled by the suggestion that they allow the administration of an agent which will quiet their nerves and make it easier for them to take the anesthetic.

They are conducted to a retiring room, and given a capsule containing 1½ grains of pentobarbital sodium, and requested to lie down quietly for at least twenty minutes. If a longer time elapse, it is just as well or better. This is a very convenient way to dispose of patients who enter the office at a busy time, and practically demand that an aching tooth be removed at once, regardless of what important procedures may be interrupted. It satisfies their demand for immediate attention without interrupting office routine.

This type, as well as the neurotic, may then be attended to at a convenient time, as they quickly become drowsy and indifferent to their surroundings.

The preoperative administration of this drug has a further advantage in that it protects the patient from the toxic effects of procaine. It likewise affords a degree of protection from surgical shock. When

1. Dysart, B. R.: J.A.M.A., 101:446 (Aug. 5) 1933.

nitrous oxide is used, it will be found that many people who could be anesthetized only with difficulty and unsatisfactorily, will take an anesthetic as nicely as those we refer to as "good" patients.

When local anesthesia is used, after such premedication, it will be found that patients submit to its administration, and subsequent operating, much better than would be likely were such premedication not carried out.

When the foregoing statements are made, the question is often asked, "Would not such premedication be useful before trying dental operations?" The answer is "Yes." It should be borne in mind that pentobarbital sodium (nembutal) is purely a hypnotic, that it does not, to any extent, relieve pain.

### SOPORIFICS

After patients have submitted to trying dental procedures, they are frequently restless, finding it difficult to sleep on the night following. From 1½ to 3 grains of pentobarbital sodium with a glass of hot milk at bed time is, in many cases, a valuable prescription.

When there is pain in addition to the inability to sleep, the patient should be instructed to use an analgesic, acetyl salicylic acid, for example, in addition. When the pain is very severe, such comparatively mild drugs may not suffice. Owing to its reputation as habit-forming drug, we often hesitate to use morphine. A new opium derivative which has been named dilaudid[2] may prove to be useful to dentists who do not care to use morphine.

This drug is given in much smaller doses; the usual dose by hypodermic being one thirty-second grain; and for oral administration, one twenty-fourth grain. It is hoped that it will be less habit forming than morphine and that there will not be the inhibition of secretions or the tendency to nausea, as with morphine.

I would recommend that those who are interested in this type of drug follow the progress of dilaudid.

We should mention, at this time, that when dilaudid, morphine, pentobarbital sodium or drugs of this character are given preoperatively, when nitrous oxide is to be administered, the respiration should be carefully watched.

### STIMULANTS

In any type of anesthesia, respiratory or cardiac embarrassment should be watched for; and one who uses anesthetic agents should be prepared to combat such failures promptly.

In the modern anesthetizing machine, with oxygen and carbon dioxide at hand, we have most effective equipment for the treatment of respiratory failure.

A drug which seems to offer great possibilities as a respiratory and cardiac stimulant in crises is metrazol. This drug may be obtained in ampules, readily usable in the injecting syringe, provided the syringe is not of the carpule type, but is the regular hypodermic syringe. It may also be obtained in solution or tablet form for oral administration.

We have found that when metrazol, or any other drug, must be administered to a dental patient hypodermically, it is well to make the injection intra-orally, at one of the sites usually chosen for the injection of local anesthetics, for the following reason: When dentists resort to the use of hypodermic medication as phy-

2. Clinical trial has not shown that dilaudid is free from tolerance and addiction evoking properties, and while side actions such as nausea, vomiting and constipation seem to occur less frequently after it than after morphine, the administration of dilaudid should be entered on with as much caution as would be exercised with morphine itself.—Reports of the Council on Pharmacy and Chemistry, J.A.M.A., 100:1031 (April) 1933.

sicians and nurses habitually do, patients are prone to attribute imaginary postoperative sequels to such treatment.

This is not only my own observation, but I have also had similar reports from many different sources.

### DIET

When patients are dismissed after severe extraction operations, they should be instructed regarding diet. Otherwise, they will frequently abstain almost entirely from food, thinking that they must await instructions lest they do themselves an injury.

In most cases, they should be told to take their usual food, as nearly as they are able, but the advantages of a dietary of such foods as orange juice, milk, eggs and nourishing soups should be stressed.

### MOUTH WASHES

The injudicious use of mouth washes may be blamed for many cases of dry socket. The intensive and misleading advertising regarding them has created a demand difficult to ignore. It is an excellent plan to provide each patient with a few alkaline antiseptic tablets, with instructions that they are not to be used until the following day. Thus, although they do no good, they can do no harm.

### SUTURES

Sutures should be used rather sparingly in postoperative extraction wounds. In general, to attempt to close such wounds tightly with sutures is to invite difficulty. When mucoperiosteal flaps fail to remain in good position, they may be held by sutures. Catgut is the suture of choice for such wounds.

Untreated catgut should never be used, even if kept in an antiseptic solution. A reliable, guaranteed brand is the only safe one to use, as untreated gut may contain any type of infection, including that of tetanus, the spores of which are well nigh indestructible.

### PACKS AND DRAINS

The insertion of wicks or the so-called packing of sockets should be limited to those cases wherein they are used for a specific purpose, such as to stop hemorrhage, to provide drainage or to "tent out" soft tissue which does not assume a good position, or for their local sedative action. Practically the only time when such crypts should be completely filled or packed is in the presence of the condition known as dry socket.

The best material for such packing that we are familiar with is a paste made by mixing a liquid composed of eugenol and a vegetable oil, equal parts, with a powder made up of zinc oxide, 70 parts, and rosin, 30 parts, into a thin paste and incorporating a few fibers of cotton in it. After irrigation and disinfection, a sufficient mass of this material is placed in the socket to slightly overfill it. In the presence of moisture, such a dressing hardens slightly. Its eugenol content promptly relieves pain, while the hardened dressing acts as a splint for the sensitive and inflamed margins of such a wound.

### THERMAL THERAPY

Brief mention should be made of thermal therapy, as the use of hot or cold applications and poultices is commonly resorted to in painful swellings about the face. It is common knowledge that poultices should always be avoided, owing to the danger of their inducing pus to point on the face, leaving unsightly scars. There is considerable confusion as to when and why heat or cold should be applied.

The matter may be rather simply stated by saying that hot wet compresses, towels wrung out of hot water or hot saturated Epsom salt (magnesium sul-

phate) solution may be safely used about the face under almost all conditions.

It is quite generally believed and borne out by experience that the application of ice caps over the site of severe operations about the face soon after such operations are completed is of considerable advantage in keeping down swelling and minimizing postoperative pain.

Lowry Medical Arts Building.

# DETERMINATION OF INDIVIDUAL CARIES-SUSCEPTIBLE AREAS, WITH A CLASSIFICATION OF CARIOUS PATIENTS

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CLINICAL experience since G. V. Black presented his cavity classification has demonstrated the value of the latter in operative treatment of caries. His differentiation between caries-susceptible and caries-immune areas of the teeth has been of inestimable importance in the planning of clinical procedure. The truth of his observations has been demonstrated so often that acceptance of them and obedience to his rules for cavity preparation have been universal.

Very often, however, it has been observed that decay has recurred about the margins of fillings that were thought properly extended. We have also noticed frequently proximal and pit and fissure fillings patently not extended out from the embrasures or to the end of the grooves and that have endured for years, often in spite of imperfect margins. We have seen tilting and elongation of the teeth resulting in abnormal marginal ridge and contact relationship, with adjacent teeth immune to caries; while, in the same mouth, areas apparently much better situated for immunity develop caries.

Wherein lies the apparent weakness and the ground for refutation of these precepts of Black's? It is not in the lack of soundness of the principles set forth by him, but in the limitations and complications associated with their application and arising from clinical conditions. Caries develops as he states; but that fact does not constitute sufficient reason for the assumption that all teeth in the mouth are equally susceptible as to those areas.

## CAVITY LOCALIZATION IN DIFFERENT MOUTHS

Examination records yield many instances wherein cavities exist on one side of the mouth only; in the teeth of only one jaw; in only occlusal surfaces; in just the proximal and occlusal surfaces of bicuspids and molars, the twelve anterior teeth being immune; in the proximal surfaces of anterior teeth, with deep lingual pits unharmed. In fact, the permutations and combinations seem as many and varied as the patients themselves.

## IMMUNE AND SUSCEPTIBLE LOCATIONS IN MOUTHS

The facts hereinafter set forth, derived from treatment of patients over a period of six years, show that regardless of tooth arrangement or relationship,

there are definite caries-immune and caries-susceptible locations in mouths of carious patients; that in immune areas, whole teeth, including their proximal surfaces, their grooves and pits, can be immune. They show that tooth areas actually exposed to caries even in the most susceptible patient are more limited than generally supposed; that the size, location and arrangement of the susceptible areas vary with the individual and according to the combination of environmental forces peculiar to that individual. These facts emphasize also that the seemingly haphazard localization of carious areas, varying as it does in different mouths and in different places on teeth, is always in only one type of area, one of relatively constant stagnation. Clinical evidence will be given to show too that these caries-susceptible and caries-immune areas can be determined for the individual patient; and that the forces governing their differentiation are of such nature that recognition of them makes possible a classification of patients having caries. This classification does not include caries-immune patients.

## WHAT DETERMINES THE POSITION OF TWO TYPES OF AREAS

The conception that excursion of food is the primary determinant of immune and susceptible areas may have held good in man's early existence and function, but the self-cleansing tooth surfaces are such, in this day at least, only as the result of a greater number of influences than just excursion of food. This is especially true when the common clinical picture of immune and susceptible areas, including a number of teeth and their surfaces, is considered. Furthermore, it is cleanliness prohibiting prolonged, localized, specific bacterial activity with which we must deal. These two conceptions entail an evaluation of the self-cleansing power of the mouth as a whole. It is this that determines the position, size and number of immune and susceptible areas in the mouth. Thus, not only excursion of food over tooth surfaces must be considered in this larger conception, but also chewing habits; muscle and tissue movement; tongue movements; tooth brushing; the solvent action of fluids and foods ingested; occlusion; articulation; the tissue relationship to the teeth; tooth form and position; the physical and chemical properties of the saliva. The extraction of a tooth; recession of a gum; change in chewing habits because of tooth loss or soreness; irregularity in marginal ridge relationship and contact between teeth; change in the excursive path of food through altered inclined planes or intercusping; depth of cusps and their driving power; tooth abrasion with its effect on food excursion and on tooth contact—all these various forces are significant in the determination of caries-susceptible and caries-immune areas.

It will be noted that some of these clinical conditions have a direct bearing on the number of areas, immune or susceptible, that are found at any given time. Others give evidence of the influence on them of change in environmental conditions. It will be shown that, while the self-cleansing power of the mouth determines the number of areas of either type at any given time, it is the degree of resistance to change that determines the transmutation or addition to one or the other type. These two phases have marked significance both in relation to the determination of caries-susceptible areas and in forming a basis for the classification of carious patients presented later. They will be discussed at that time.

## DETERMINATION OF INDIVIDUAL CARIES-SUSCEPTIBLE AREAS

While an explanation as to why one

area is immune and another susceptible embodies considerable detail, the actual determination of them is comparatively simple when considered in the light of self-cleansed and stagnant areas. If every surface, groove and pit of every tooth is stained and then left for the various forces of activity peculiar to that mouth to act on the stain, the immune areas are disclosed by the disappearance of the stain from all surfaces, grooves and pits in those areas. The susceptible areas are those in which the stain persists in spite of all the various forces, acting over a period of time. The latter varies somewhat, but experience has shown that the stain remaining up to a week or ten days accurately discloses caries-susceptible areas.

### REQUIREMENTS OF MATERIALS USED

In the period of time over which this work extends, the following stains have been used: mercurochrome (aqueous), 2, 5 or 10 per cent or saturated; iodine, ordinary 3 per cent, Churchill's or Skinner's disclosing solution; acriflavine, aqueous 5 per cent; tincture of metaphen; methylene blue, saturated; gentian violet, 2 per cent; saturated potassium permanganate with boric acid; gentian violet saturated in absolute alcohol. The last is, at the present time, the one of choice.

It was found that stains in aqueous solution were not suitable for use because of rather rapid dissipation. Stains in olive oil were also tried, but were not much more satisfactory; for while the stain persisted longer than an aqueous solution, it did not persist so long as an alcoholic solution. The latter was found the most desirable for two reasons: greater persistence and the ability to evaporate the solvent before subjecting the stained areas to mouth fluids. As a result, the following are the requirements of the material used: (1) insolubility in mouth fluids; (2) freedom from toxicity; (3) lack of irritating qualities; (4) distinguishability from stains ordinarily found in the mouth.

### TECHNIC

1. The mouth is divided into six segments, three to each jaw. One segment at a time is packed and thoroughly dried with warm air.
2. One tooth at a time in the segment is stained, a cotton pellet dipped in the staining agent being applied to every surface, pit and groove of the tooth. When one tooth is done, the adjacent one is gone over, until every tooth in that segment is stained.
3. With very little air pressure, the alcohol is evaporated with warm air.
4. Packs are removed, and the patient is allowed to rinse the mouth with water.
5. The same procedure is followed for each segment, until the work of the whole mouth is done.
6. The patient is then dismissed, the operator emphasizing that the value of the procedure is lost unless only the ordinary routine is followed as in the past. No special attempt must be made to remove the stain, although the teeth can be brushed in the usual manner.
7. The patient is examined in a week and all stained areas are recorded.

### RESULTS

Forty-eight hours after the application of the stain, the mouth is practically free from stained areas, except that every cavity present will be stained. From that time to the end of the seventh to fourteenth day, there may be an occasional elimination of one or more of the stained areas. Any stained area persisting that long is considered a caries-susceptible area. The stability of the stained areas with respect to disturbing forces varies, the stain often being demonstrated in

these areas three and four weeks after its application, but disappearing after that. The value of forces other than food excursion in cleansing action has been demonstrated in the case of teeth not occluding with opposing teeth. In the proximal surfaces, wide variation in size and shape of the stagnant areas has been observed. Stain will remain on the proximal surfaces of one tooth and will be removed from the adjacent surface of the next tooth. Areas that develop incipient caries when at the gingival margin in one stage of eruption, but become arrested in progress when transposed to the middle third of the buccal surface after full eruption of the tooth, have been observed to lose their stain simultaneously with other buccal surfaces in that mouth.

Regardless of the type of contact, and the presence of grooves and pits, removal of the stain in the immune areas is complete. All spots of active caries, no matter how small, retain their stain. This has been observed even in the middle third of the labial surface of a cuspid. Part of the distolingual groove of upper molars and occlusal grooves of lower molars have been stained, while the remaining part of the groove loses its stain. The influence of a cavity and the subsequent filling of the cavity, with restoration of contact, upon the development and the elimination of stagnant areas on the same side of the arch has been observed. Examples are: the filling of a mesioclusal cavity in the upper right second molar resulting in the disappearance of a stained area between the upper right first and second bicuspids as discovered two days after the filling was placed; and the distal filling of an upper cuspid eliminating stained areas on the distal surfaces of the first and second bicuspids. Stains in other parts of the mouth remained. The penetration of the stain has been found to vary, being deep in some cases of caries and superficial in others. It does not penetrate sound tooth structure.

## SIGNIFICANCE OF RESULTS

There are three phases to the significance of these results: namely, the clinical, the prophylactic and that related to the conception of caries.

*Clinical Phase.*—One cavity apparently can beget other cavities in adjacent teeth. It is a matter of common clinical experience to find cavities in various degrees of development on the same side of the arch. The fact that the filling of one cavity results in elimination of stain on the other surfaces not only suggests this influence of one cavity on the development of others, but also suggests the prophylactic value to other teeth of restoring one carious tooth to normal contour. It also suggests the dangerous possibilities of the improper restoration of such a tooth.

*Prophylactic Phase.*—The degree of self-cleansing obtained by the combination of forces peculiar to the individual determines the number of stagnant areas and therefore the caries-susceptible areas for that individual. The results provide an explanation for both the failure of tooth brushing as an effective weapon in the prevention of caries and the common clinical experience of relative freedom from caries in spite of poor habits of mouth hygiene. The toothbrush is effective only when it accomplishes regular cleansing of stagnant areas remaining after all the natural disturbing forces of the mouth have functioned.

When the patient can be informed as to the definitely susceptible areas in the mouth, his ability to combat the development of caries is considerably enhanced.

*Phase Related to the Conception of Caries.*—Regardless of what opinion is held concerning the etiology of caries, these results place significant emphasis

on the rôle of environmental factors in the development of the clinical picture of that disease. They indicate also, as will be found in the latter part of this discussion, that in the variation of susceptibility from time to time, as shown by the development of new cavities, the bacteriologic phase is secondary to the development of new areas of susceptibility or stagnation, which favor the increased bacterial activity. Of equal significance is the fact that the results indicate a definite difference between the plaques commonly found in the mouth and the plaque found in a stagnant or carious area. No matter how heavy or large the usual plaque, stain disappears readily; while no matter how small or fine the plaque in the stagnant or carious area, the stain remains as described.

### CARIOUS PATIENTS

While we have a seemingly wide variety of types among our patients, they can be classified rather definitely according to susceptibility. This relative susceptibility is determined by the number of cavities present at any given time, by the frequency with which new cavities appear and by the rate of disintegration of the tooth itself. Since the disintegration of the tooth itself results from solution of its inorganic content, the rate of that disintegration will be definitely affected by the density or structural integrity of that tooth.

### BASIS OF CLASSIFICATION

The basis of our classification of carious patients, therefore, is the clinical evaluation of the patient in respect to these three things: (1) self-cleansing powers of the mouth; (2) degree of resistance to change, and (3) rate of tooth disintegration as controlled by tooth structure and chemical composition as indicated by tooth shade.

### SELF-CLEANSING POWERS OF THE MOUTH

There are five factors in the self-cleansing powers for each person: (1) chewing habits; (2) tooth contact; (3) tooth form; (4) tissue relationship to the teeth, and (5) physical and chemical properties of the saliva.

*Chewing Habits.*—Concise enunciation of this rather abstract phase is somewhat difficult. There are certain definite aids in their determination. A poor development of the jaw, marked malocclusion and mouth-breathing indicate poor functional habits. The patient who has difficulty in opening the mouth is a poor chewer. Copious salivation is found in the food bolter. In an adult, well rounded cusps showing little if any abrasion lead to the conclusion that chewing is weak. The languid individual with lips loose in repose is not an active chewer. The gums in such cases are pale pink (anemic) to light lavender in tint. They lack the glossy sheen a healthy, well-stimulated gum has, and they bleed easily. The gingival crevice in this type of mouth is often rather deep; the epithelial layer is thin, and the tissue is quite sensitive even to light gentle exploration with a peridental membrane explorer.

On the other hand, the mouth easily and widely opened; compressed lips; abraded cusps; well-defined inclined planes; good occlusion; well-formed arches, and deeply tinted, shining gums with gingivae closely adapted to the tooth surface and hardy epithelial layer indicate active functional habits. All these are of assistance in evaluating chewing habits and their importance in respect to the self-cleansing powers of the mouth.

*Tooth Contact.*—The importance of tooth contact rests upon its relation not only to the excursion of food in that area, but also to food impaction, with its injury to septal tissues. There are three types of tooth contact, based on the circumfer-

ential shape of the teeth and on the form and slope of the marginal ridge, the latter determining the vertical position of the contact point in relation to the crest of the marginal ridge. The differentiation between the three types is based largely on the shape of the bicuspids and molars; for it has been found that there is generally a characteristic conformation of the anteriors in each type.

Type 1: Rectangular. The cross-section of the tooth approximates a rectangle with rounded corners. The palatal or lingual mesiodistal diameter is nearly that of the buccal. This is particularly true of the molars. This shape in the teeth results in a broad contact buccolingually, as shown in Figure 1. The marginal ridges are full, with well-rounded slopes, the point of contact being well below the occlusal crest of the ridge. (Fig. 2.) This is a particularly vicious type of contact in respect both to excursion of food and to food impaction, resulting in the early appearance of proximal caries.

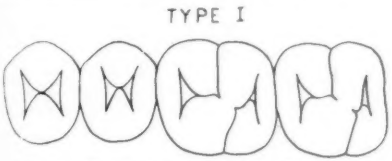


Fig. 1.—Type 1: Rectangular. In this type, broad buccolingual contacts, with the contact point well below the occlusal crest of the marginal ridge, are characteristic.

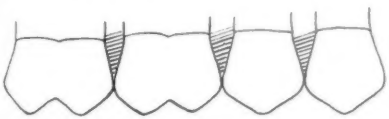

Fig. 2.—Type 1. (Compare Fig. 1.)

Type 2: Ovoid. This type is characterized by marked tapering from the buccal to the lingual or palatal aspect of the proximal walls, resulting in a shorter mesiodistal diameter on the lingual than on the buccal aspect. There is also a more or less pronounced constriction from the occlusal to the gingival aspect. The marginal ridges are shallow and, while not pointed, the convexity is similar to a segment of a much smaller circle. The result is a "billiard ball" contact point, as in Figure 3. This is high, and rather close to the occlusal plane, resulting in a rather pointed embrasure, as shown in Figure 4. Long cusps and deep grooves are other characteristics of this type. Instead of approximating right angles, the angles of the molars are definitely obtuse and acute, with triangular second molars quite common.

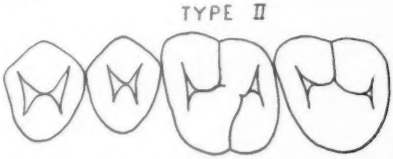


Fig. 3.—Type 2: Ovoid. In this type of contact, there are excellent self-cleansing conditions, but with the septal tissue greatly exposed to injury.

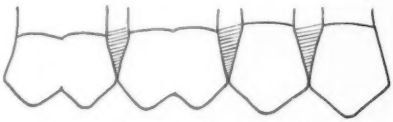

Fig. 4.—Type 2. (Compare Fig. 3.)

Ordinarily, this type of contact is highly protective as far as food excursion is concerned, and, as long as the septal tissue is normal, food impaction will not occur. But if gum recession or injury to the septal tissue by disease (Vincent's, for example) from calcular deposits, or by other means, occurs, we have a highly susceptible area resulting, because of the constrictive sloping of the proximal walls. This condition is further aggravated by the saucer-like depression in these walls usually found just gingivally and lingually from the contact point in this type

of tooth; also by the fact that since the septal tissue is narrow and pointed occlusally, any blunting becomes quite telling in effect.

Type 3: Round. This is the most nearly ideal type of interdental relationship. The bicuspids are noticeably round or elliptical. The molars are almost square, with all four angles bordering on the obtuse, so that the proximal surfaces at the marginal ridges are slightly convex. The proximal walls are rather straight, with marginal ridges not so well defined, because of the rather flat occlusal surfaces. They are rounded much as in Type 2. There is a significant difference in the septal tissue in this type. The triangle formed by the embrasure is shorter, a thicker septal tissue less subject to

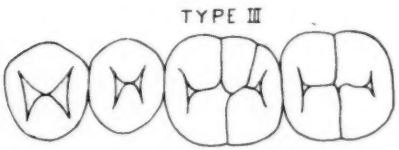


Fig. 5.—Type 3: Round. While the contacts are rather broad, the contact point is practically at the occlusal crest of the marginal ridge. Protection is afforded the septal tissue.

injury and early recession resulting. Figures 5 and 6 illustrate this type, the former in cross section, the latter depicting the vertical position and type of contact, also the shorter septal tissue.

A combination of Type 2 or Type 3 in the bicuspid region and Type 1 in the molars is seen quite often. The first combination affords early freedom from caries in the bicuspid region, but caries develops in the proximal molar region, proximal caries of the bicuspids appearing in adulthood. The second combination renders the bicuspids relatively immune to proximal caries.

It should be noted that, in all these types, while the excursion of food is naturally of importance, the primary significance rests on the influence of this interdental relationship on food impaction and on changes in the septal tissue, with their sequelae.

*Tooth Form.*—The conformation of the teeth is important also in respect to the type of grooves and pits, the length of cusps and the contour. The importance of cusp length rests primarily in its influence on resistance to change and so will be considered under that heading.

Grooves and Pits. There is a definite character of groove and pit seen in the three types of teeth mentioned. In Type

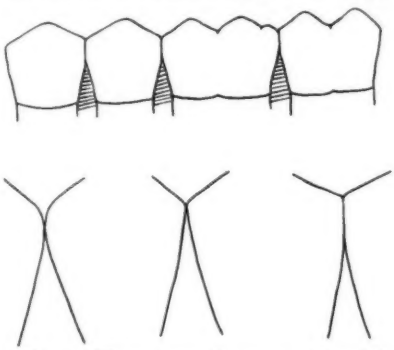

Fig. 6.—Three types of contact. From left to right: types 1, 2 and 3.

1, they are broad and deep. In Type 2, they are well defined, but not so wide and deep. The grooves between the cusps of the molars usually extend over on the buccal and lingual surfaces, well down to the middle third, ending more abruptly than in Type 1, where they shallow and widen out into a flare. We find the grooves more numerous in this type, often several fine grooves running from each cusp to the central groove. In Type 3, the grooves are shorter, seldom running over from the occlusal surface, and are very fine. In the bicuspids, the cusps are often connected by a ridge dividing the occlusal surface into two depressed areas

with well-rounded pits. The molars have grooves usually not more than fine lines, but with deeper central pits.

*Contour.*—The self-cleansing obtained on the axial surfaces of the teeth is influenced decidedly by the amount of curvature in relation to the gum margin. Generally speaking, it can be said that the nearer the greatest diameter of the tooth to the middle third, the less pronounced the curvature and the better the excursive results. The wider and gentler the curve incisogingivally, the better the protection against caries. When the greatest diameter approaches the gum margin, the constriction toward the gingiva is sharper, resulting in a definite overhang, and the surface between it and the gum margin becomes highly susceptible to caries. The type of tooth most immune to marginal caries is the tapering tooth with the point of greatest diameter at the gingiva. Even when gum recession exposes the root surface, caries does not occur unless hypertrophy of the gum tissue results in such a piling up of tissue that lodgement of detritus results. Figure 7 shows these various characteristic contours.

Fig. 7.—Characteristic occlusogingival slopes to buccal and labial surfaces. While modified to some extent according to the tooth, all five types are found in anterior teeth, bicuspids and molars.

Fig. 8.—Dip of septal tissue through the embrasures beneath contact points.

Fig. 9.—Increased retraction of tissue beneath contact points, due to injury to septal tissue.

*Tissue Relationship.*—Any deviation from normal tissue relationship to the tooth increases the caries hazard existing because of predisposing conditions due to tooth form, contour or tooth contact. This deviation may be due to trauma as a result of food impaction, disease or calcular deposits. It may also be due to the natural recession of the gum as the age of the patient increases. The result of this natural recession during maturity is as significant in caries development as the effect of trauma.

Fig. 10.—Uniform retraction accompanying recession due to increasing age.

Fig. 11.—Septal tissue recession (illustrated by dotted lines) in case of greater injury on one side than on another.

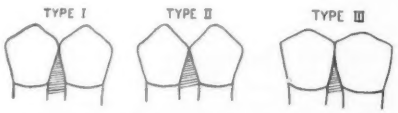


Fig. 12.—Relative exposure of septal tissue to injury in three types of contact.

One should keep in mind the fact that there is a dip in the septal tissue between the buccal and lingual crests beneath the contact point so that the cross-section when viewed from the mesiodistal position presents a u-shape. The depth of the depression between the crests varies with the breadth of contact, shapes such as shown in Figure 8 resulting.

When the septal tissue is injured, retraction is more pronounced between the

crests, the tendency shown in Figure 9 by the dotted lines resulting. In the case of normal recession, we have a more uniform result, such as is shown in Figure 10.

With the tooth contact remaining firm, the result is a favorable site for stagnation and collection, the degree of protection depending on the firmness and breadth of contact. It is further enhanced also if the injury is only on one side or more on one side than on another. This is because there is a reduced tendency to buccolingual movement of fluids or detritus. Figure 11 shows this result.

It will be seen readily, therefore, that with the result of injury or recession as it is, the degree of exposure to injury increases as the septal peak approaches the occlusal surface, and the slenderer the septal crest, the more liable it is to injury. This occurs to greatest degree in Types 1 and 2 contacts. As mentioned previously, the axial walls in a Type 3 tooth are straighter, so that the triangle of septal tissue is shorter and broader and therefore more resistant to and better protected from injury. (Fig. 12.)

Gingival tissue (buccal or lingual) has a more passive relationship to the development of stagnant areas. In these locations, tooth contour is primary in importance except when the gingival tissue recession from any cause exposes root surface. If the recession is due to natural causes and there is no inflammation, the susceptibility is only such as is already present from tooth conformation. If inflammation is present, the hazard can be enhanced by the accompanying hypertrophy.

*Saliva.*—The importance of the saliva as it influences the cleansing of the tooth surfaces, the retention of débris, and the incorporation of potentially harmful ingredients cannot be overlooked. These conditions are dependent on certain physical characteristics of the saliva. It has been observed constantly that thick, ropy saliva offers much greater resistance to disturbance than thinner saliva. This type of saliva envelops the teeth with a salivary film difficult to disturb or penetrate physically, although its absorption of stains or fluids is little different from that of other salivas. While this type tends to maintain food in a well-defined bolus, on the one hand, it offers a protection to concretions, on the other hand, that is relatively difficult to combat by ordinary means.

The thinner, less viscid type, although it offers quicker and easier spreading of mouth contents over tooth surfaces, and in crevices, offers equal ease of disturbance to the resultant débris or concretions.

### RESISTANCE TO CHANGE

At first thought, it might seem odd that changes in tissue relationship and tissue resistance to change are not included under this heading, but we must bear in mind that even in the case of the normal recession incidental to increasing age, the effect of tissue change is secondary to and subject to the influence of other conditions. There are three factors in the everyday functional activity of the mouth which can and do affect the very basic framework of the chewing mechanism so that the whole picture will be altered according to the extent of their influences. These are jaw density, length of cusps and intercusping. While the degree of functional activity and tooth structure will determine the rate or intensity of reaction to these influences, the actual development or absence of reaction is determined largely by these three.

*Jaw Density.*—This distinction is made because more is involved than just bone density. Most of the stress and strain borne by the teeth during function is directed laterally or mesiodistally to the perpendicular plane until the climax of

the chewing movement is reached. This requires a buccal, septal and lingual partition that is not only dense, but also of a thickness commensurate with the force of mastication. It is important, therefore, to determine the gross structure of the jaws in proportion to the size of the teeth, and the thickness of the alveolar plate as evidenced by the bulge about the occlusal half of the root and by the appearance or absence of root convexity just under or near the mucosa. This is particularly significant when abraded facets indicating heavy chewing, and long cusps are present. In the roentgenogram, finely woven trabeculae with small spaces are more reliable indications of this phase than the degree of radiopacity. The latter, while of obvious value, varies too much with age and local conditions of irritation or stimulation to be accurate at all times. The thickness and height of the interdental wall is also significant.

*Length of Cusps.*—The bicuspids are considered the key teeth in every condition in which the teeth themselves are involved. This is particularly true in a consideration of the length of the cusps and its relation to change of environmental conditions due to function. Most of our chewing is done in the bicuspid and first molar region. This is due largely to the fact that food manipulation in the process of chewing is accomplished with the cheeks, lips and anterior half of the tongue. This places the bicuspids in a strategic position to feel, and to react to, any force associated with function.

The longer the cusps, the greater the divergence of masticatory stress from the perpendicular. In the case of grinding, the direction of force will be buccolingually; in intercusping, mesiodistally. Both directions have high displacement possibilities. The reaction to these forces will be seen in abrasion of the cusps; abrasion of the contact point opposite the point of application of greater force; opening of the contact at that point; lateral displacement of the teeth; increased mobility of the teeth, and mesiodistal shifting of the teeth.

All these results tend to vary in degree in proportion to the length of cusps. We have therefore less tendency to change in short cusps and a greater tendency in long cusped teeth. There is a corresponding influence on both the formation and the alteration of caries-immune and caries-susceptible areas.

The character of the intercusping between upper and lower arches will modify the tendency latent in the cusps themselves. In end-to-end articulation, for example, the influence of most of the force of mastication in respect to change is lost because of the absence of intercusping. Rotated teeth may be less exposed also to change.

There is one type of arrangement seen rather often, with definite intercusping that is highly resistant to change. That is one in which the teeth are widely spaced. The interdental wall of bone seems to be thick enough in this condition to render such teeth highly immune to functional change.

## TOOTH SHADE AS AN INDICATION OF TOOTH STRUCTURE

Observation of 132 patients over a period of time varying from three to ten years offers some convincing clinical evidence that there is a relationship between tooth structure and tooth shade. This is borne out by further clinical observation on other patients. This opinion is based upon observation of the rate of tooth disintegration as a result of caries, and involves density as distinguished from cleavage. It includes both enamel and dentin. A detailed report of this is to be given at a later date.

It has been noticed that there are four

basic shades—white, blue, yellow and brown. As the proportion of yellow increases, so does resistance to disintegration. In the white, bluish white and grayish white shades, disintegration is most rapid. When the basic blue combines with yellow, a greenish yellow shade resulting, the tooth is more impervious. The light yellow to yellow is still more resistant. In the case of the teeth tinted brown, one would be tempted to call the shade dark yellow except that there is an orange-brown cast even in childhood. The latter division has an added characteristic, a tendency to abrasion, so that, in adult cases, the occlusal surfaces of the bicuspids and molars are almost cuspless, with the anterior teeth shortened correspondingly.

To summarize briefly the foregoing: Regardless of size or depth of groove and pit, and regardless of the tooth surface exposed, such groove, pit or surface will become carious if it lies in a location of stagnation in a carious mouth. These stagnant or carious areas vary in number and in frequency of development according to the self-cleansing power of the mouth and the resistance its various components offer to functional change. Lastly, the relative degree of resistance to destruction offered by the tooth, which is dependent on the tooth structure, can be determined clinically by the basic shade of the teeth.

One finds a significant correlation between these facts and the clinical picture presented by patients needing treatment for caries.

In considering carious cases as a whole, I disagree with the opinion that caries is primarily a disease of childhood, or even of adolescence. Childhood and adolescence are decidedly a period of pit and fissure cavity development. In the case of Type 1 teeth, proximal caries can and does appear also. But interproximal caries is largely an adult manifestation, although the time of its appearance can be advanced considerably when septal injury, by disease, the presence of calcular deposits or other conditions simulate those conditions peculiar to maturity. Uncompensated loss of teeth in that region exerts a like influence. This does not mean that pit and fissure cavities do not develop during adulthood, but when a hitherto immune pit or fissure becomes a susceptible area, it becomes so primarily through the influence of changes which have taken place in the interproximal regions.

The significant relationship between the foregoing facts has been observed in the study of the 132 patients already referred to, with the following results:

1. When I examine an adolescent and find the shade of the teeth is basically white, I know first that, once a carious lesion appears, the development of that lesion will be rapid. On examination of the teeth, if both molars and bicuspids are of Type 1, we will find either cavities or fillings in the pits and fissures and very probably in the mesial surfaces of one or more first molars. Early appearance of occlusal caries in the bicuspids will be common. The buccal pits of the lower molars and the distolingual grooves of the upper will tend to develop caries early. As the bicuspids erupt, proximal caries will be seen occasionally if eruption is slow, because of the v-shaped depression from the crest of the ridge to the contact point, and the broad contact favoring collection of débris there. If eruption is normal in rate, proximal caries does not appear at this stage, but it does develop early in adolescence if a soft diet is evident from snubbing of the septal crest as a result not only of soft food impaction, but also from the inflammatory reaction to its fermentation. If the diet is firmer in consistency, this effect is absent, but

the broad low contact, favoring both impingement and early recession, soon offers favorable sites for stagnation.

This picture is enhanced or softened according to the degree of functional activity. If the jaws show poor development and density, the saliva is ropy (even if copious) and the teeth are large or long, the tendency to caries is still further increased. Long, tapering anterior teeth, with long narrow septal tissue, usually spell an early appearance of caries there, and are common in this type of case. Early recession of septal tissue is common in the anterior region also.

During maturity, the progressive appearance of new cavities can be expected. As the gingival tissue recedes, recurring caries is common. Loss of teeth begins early and the changes incidental to that loss are rapid and still more telling in effect, so that this combination of shade, tooth and jaw, with its effects on tissue relationship and self-cleansing power, is the most deadly of all.

When one sees a Type 2 bicuspid in this type of patient, as is often the case, one can expect a wider spread to the panorama of caries, so that while the end-result may be the same, the time involved may be longer, and the condition less acute, because of the relatively greater immunity of the bicuspids to proximal caries during adolescence, until gum recession or injury from disease renders them characteristically susceptible. Consequently, early concern will be with the molars and anterior teeth. The bicuspids will be free from occlusal caries if the central groove or the pits are shallow and fine or will have only pit and fissure caries.

When Class 3 teeth are found, a reduction of the possibility of caries is found to pit and fissure development until late adulthood or until the results of disease, trauma or soft food impingement establish in the tissues the relationships of old age.

2. There is another group in which one can expect as extensive a susceptibility to caries, but not so intensive as in the basic white tooth. All things stated for it hold good here too. But caries will be slower. The influence of jaw density, functional habits and self-cleansing powers are as in the case just mentioned. The same types of teeth and their combinations are found. This group comprises the larger of the two in numbers, the proportion in the group under observation having been as seventy-one to twenty-nine.

In childhood, this tooth will be seen as of a highly translucent creamy shade with a blue or greenish gray cast. The shade can be identified best, perhaps, by the statement that matching it can be accomplished by combination of various proportions of No. 14 De Trey synthetic with No. 3. As the age increases, No. 4 or 5 is often used instead of 3.

3. This group and the one following will be found to be so consistently true to type that they can be recognized immediately and prognosed with considerable accuracy. When one sees a case of Type 2 teeth, basic yellow in shade, one will find a hard tooth highly resistant to decay, and one in which the enamel will be difficult to penetrate with burs. The grooves in the bicuspids and molars will be fine, but pronounced. In childhood, when one finds caries, it will be in the grooves of the lower first molars and the distolingual grooves of the upper first molars. The distolingual grooves of the upper second molars, in the case of four cusps, and the central pits in the case of three cusps, will be the next points showing caries. The lower second molars usually develop central pit cavities.

Serumal and salivary calculus are characteristic of this type. The excessive

flow of saliva and the "ropy" type so often seen in the two preceding groups have not been observed in this type. Saliva varies in quantity, but is usually moderate in amount and thin in consistency.

Where deposits are negligible or are removed carefully and often, proximal caries often does not appear until the patient is in the 30-year period. The bicuspids will usually show proximal caries first. Any injury to the septal tissue from any source will advance the period of susceptibility to this type of decay. Serumal calculus is the most common causative agent when this happens. The destructive influences of the pronounced intercusping associated with this type of tooth, and the marked exposure of the septal tissue to injury combine to make interproximal caries a definite characteristic of this group during maturity. The self-cleansing power in this group is of a high order so that intermittent appearance of an occasional carious area is the normal expectancy.

4. A definitely basic yellow tooth uniformly Type 3 in form and contact can be expected to be the most highly resistant of all to caries. In childhood, an occasional pit cavity, small and slow to develop, may appear, as may caries in the fine hairlike grooves in the first molars, central pits of the lower second molars and upper first molars or distolingual grooves in the upper second molars. Very often, no caries at all is found during adolescence. These patients are so accustomed to freedom from caries that the mouth is usually neglected. The result is that gingival injury because of calcular deposits often offers an opportunity for proximal caries to develop. This is generally in the bicuspid region. A large number of these patients do not develop caries until abrasion, a marked characteristic of this group, wears down the short cusps and marginal ridges, food impaction forcing back the tissue and proximal and gingival third caries developing thereafter.

The teeth are firmly imbedded in a heavily formed jaw. The functional habits are excellent. The saliva is thin.

It is in this group that one most often finds arrested caries, with the etched areas a dark brown. This is observed most often on exposed root surfaces gingivally from the enamel, or just gingivally from the contact point of a heavily abraded occlusal surface, which leaves a sharp marginal ridge.

In reviewing the preceding, one finds an almost monotonous enumeration of tooth conformation, tooth contact, tissue relationship, tooth form and jaw density. This cannot help but emphasize their importance in relation to caries-susceptibility; but one with any clinical experience at all will recognize immediately the absurdity of classifying patients according to these factors. Poor and good jaw density, various characteristics of tissue relationship, tooth form and tooth relationship are found in every group described, although the last two are more nearly uniform in all respects.

One thing will be found of dominant importance in each group: the basic shade of the teeth. This, too, may seem undependable unless one remembers a significant fact in connection with the first part of this paper. It will be recalled that the stagnant areas remained stained longer than most active areas, but that these areas too lost their stain ultimately. This indicates that the stagnation is largely relative and not absolute, so that while these are the caries-susceptible areas, their actual exposure to the process of caries may be intermittent. The influence of tooth structure is then self-evident, and is borne out by the clinical facts.

Our classification is therefore founded

on basic shade with the other factors included under resistance to change and self-cleansing power as modifying or further identifying influences. This classification of carious patients then becomes:

Class 1. Highly susceptible.

Division A. Basic white, Types 1, 2 and 3 teeth.

Division B. Greenish yellow, Types 1, 2 and 3 teeth.

Class 2. Moderately susceptible.

Division A. Basic yellow, long cusps, Type 2 teeth.

Division B. Brownish yellow, short cusps, Type 3 teeth.

In adapting clinical findings to such a classification, confusion is liable to result if one attempts too rigid a conception of time in terms of years. Furthermore, it must be borne in mind that eruption of teeth, loss of teeth, altered tissue relationship and the abrasive effects of function are predisposing conditions and that their effects vary according to the classification to which the patient belongs.

Time except in relation to tooth disintegration is divided into two periods: development and maturity. The period of development is that through childhood and adolescence; that of maturity comprises complete adulthood.

There is another potential source of confusion — those patients who enjoy what may be called geographic immunity. These are the patients who are completely immune in one mode or location of living but who develop varying degrees of susceptibility when this is changed. The Spaniard, German or Italian who is immune in his natural, native standard of living and environment, but who develops caries on coming to America is an example of this type. Observation of these has shown that they are immune because of a combination of happy circumstances and that they should not be considered in the same category as the patient who enjoys immunity regardless of occlusion, diet, tooth structure or any other aberration of environment. Only the latter type of patient enjoys a natural or true immunity. The former type of patient develops caries according to their station in the foregoing classification.

## PRACTICAL VALUE OF SUCH A CLASSIFICATION

As a result of the clinical application of the foregoing classification, one is better able to determine proper treatment for each patient and to prognose the results of treatment or of its neglect. For example, for successful treatment, every means known must be resorted to in the case of Class 1, Division A patients. This is the only type wherein I believe that practical odontology might be justified as a routine measure. In reparative work, the most rigid adherence to the rule of extension for prevention must be observed. All teeth lost should be replaced as early as possible. Reduction to the minimum of foods offering sources of fermentative activity is advisable. Examination should be frequent and regular. Prophylaxis must be frequent and thorough, on the part of both dentist and patient. Any opinion as to prognosis should be conservative even under the best of circumstances and with the best of cooperation.

The chief value with respect to Division B patients is in one's ability to offer more favorable prognosis as to ultimate results. Successful care entails as close attention as in Type 1.

In Class 2, Division A, special attention must be given to protection from injury to the gingival and septal tissue. One should anticipate recurrence of caries at the gingival margin of fillings placed early. In the case of injury to septal tissue, added precaution

with regard to measures of interproximal prophylaxis is indicated. Prompt replacement of lost teeth is also advisable.

In relationship to our search for valuable aids in the determination of the etiology of dental caries, all this is, I believe, significant in stressing the importance of environmental factors in the development of caries, rendering more tenable the belief that the secret for which we are all seeking lies on the surface of the tooth in conjunction with salivary and bacterial activity.

# DENTAL EXTRACTION IN HEMOPHILIA*

By WALTER WILLIAM DALITSCH, M.D., D.D.S., Chicago, Ill.

HEMOPHILIA, a hereditary tendency to bleeding occurring in males, is of especial interest to the dentist and oral surgeon because of the possibility of serious and occasionally fatal hemorrhage following dental operations, especially tooth extraction.

Oral bleeding as a result of dental disturbances is one of the most dreaded and yet most common episodes in the life of an hemophiliac. Dental caries, as an almost universal affliction of civilized mankind, has been shown to be the most common defect found in various physical surveys, and hemophiliacs are just as often affected by dental disease as are other persons. In them, such disease assumes a serious aspect and becomes a problem of major importance because it may be complicated by severe and uncontrollable hemorrhage.

Despite the fact that oral bleeding is a common experience in hemophilia, and that excessive hemorrhage occurs not uncommonly in oral operations, review of the literature reveals a paucity of reports of such cases. Reports of excessive hemorrhage in the dental literature are often incomplete and, in most cases, are obviously not those of true hemophilia. It appears to be common practice to call all abnormal bleeding hemophilia.[1]

It is necessary that an accurate diagnosis of the underlying cause of a hemorrhagic diathesis be made, if we are to obtain effective therapeutic results. This calls for thorough physical and laboratory examinations, especially complete blood and platelet counts, coagulation and bleeding time determinations, fragility tests, etc., to distinguish between bleeding due to delayed coagulation, as in hemophilia, and that due to degenerative, toxic or infectious injury to capillaries, or platelet formation resulting in increased bleeding time, as occurs in purpura, primary or secondary, and in leukemia, scurvy, etc.

In hemophilia, the blood clots very slowly. It has been found best to draw blood from a vein and run it into a test tube to test for coagulation time (Howell's method). A varying time up to several hours may be required before

*Read at the Eighteenth Annual Clinical Session of the American College of Physicians, Chicago, Ill., April 19, 1934.

1. Moral, Hans: Fortschr. d. Zahnheilk., 4: 136 (Feb.) 1928; abstr. J.A.D.A., 15:2378 (Dec.) 1928.

a clot forms. The coagulation time varies considerably from time to time, and there appears to be a cyclic periodicity to the character of the clotting time. Thus, in a study made by Dr. Birch, the coagulation time would be longest about every fourth to sixth week, suggesting a possible resemblance to the menstrual cycle in females. There is some evidence that the urine of severe hemophilia may be deficient in the female sex hormone as determined by biologic assay on rats, but investigation of this aspect of the condition and comparison with conditions in normal persons has not been completed.[2]

The clot, when it does form, retracts, and the serum is extruded. The number and form of the blood platelets (thrombocytes) are normal, but they show an abnormal resistance to hypotonic salt solutions. Experimentally, it has been shown that if this abnormal resistance is overcome by mechanical traumatization, normal clotting will occur.[3]

The purpura or leukemia cases are likely to present, with initial oral symptoms, no previous history of bleeding, and the true condition remains undiscovered[4]; while the hemophiliac will usually know of his condition and will give a history of previous hemorrhages and thus forewarn the dentist.

In the past few years, considerable study of hemophilia has been done by Carroll L. Birch at the University of Illinois, and many interesting characteristics of the disease have been determined. While hemophilia is usually considered a rare disease, Dr. Birch's experience shows that it is not uncommon. Seventy-five cases have been studied directly and contacts have been made with about 300 from all parts of the country. Dr. Birch has shown that it is the most strictly hereditary of all inheritable diseases. It has been traced in one family for over 200 years, through six generations, sixteen persons having active symptoms.

The disease is transmitted directly through the females, but is manifest only in the male. Theoretically, all of a hemophiliac's daughters will transmit hemophilia to 50 per cent of their sons; while 50 per cent of the daughters of a transmitter will convey the disease to 50 per cent of their sons.

In the history that these persons may give of bleeding in themselves or in male relatives on the maternal side, the condition may assume various manifestations. Hemorrhages after falls, cuts and other injuries are quite common. Death at birth, due to bleeding from the cord, has been noted. Fatal hemorrhage following circumcision occurred in four consecutive sons of one family. Hemorrhage into the joints is quite characteristic and often results in permanent deformity and disability. Spontaneous bleeding from the kidneys results in hematuria. Nasal bleeding and gastro-intestinal hemorrhages also were frequently recorded.

While such history of bleeding episodes may help to establish a correct diagnosis, it may also lead to an erroneous conclusion. Thus, for instance, in some cases, hemophiliac arthropathy was thought to be due to rheumatoid conditions. Hematuria was considered due to the presence of renal stone or tuberculosis. One patient had a multiple diagnosis made of gastric ulcer because of vomiting of blood; hemorrhoids because of blood in the stool; kidney stone because of periodic hematuria; arthritis because of stiff, painful and swollen joints, and pyorrhea because

2. Birch, C. L.: Hemophilia and Female Sex Hormone, J.A.M.A., 97:244 (July 25) 1931.

3. Birch, C. L.: Hemophilia, J.A.M.A., 99: 1566 (Nov. 5) 1932.

4. Haman, G. L.: Treatment of Hemorrhage, J.A.D.A., 14:1984 (Nov.) 1927.

of bleeding gums. The condition of the gums, a focus of infection, was held responsible for the arthritis.

Hemorrhage from the oral tissues may assume varied aspects. Trauma as a result of falls, of biting the tongue or lip or of chewing on hard or sharp food particles may initiate bleeding. Bleeding may occur at the time that the deciduous teeth emerge through the gums, but this happens with greater frequency at the time the deciduous teeth are shed. As the roots of the deciduous teeth are absorbed, the remaining crown portion presents a thin, sharp and irregular margin at its attachment to the gum, and pressure from biting allows this sharp edge to cut into the highly vascular gum tissue, resulting in laceration and severe bleeding. Such repeated, frequent hemorrhage may practically incapacitate the sufferer for the whole period between the first and second dentitions.

One of our patients had the following experience: An impression of the upper gums was taken. The impression material adhered firmly to the tissues and, in an attempt at removal, suction was produced which caused an extravasation of blood into the loose tissues of the soft palate, but which did not break through to the surface. An extensive hematoma with marked embarrassment to breathing and swallowing resulted.

Another patient developed severe bleeding of several days' duration from the gingival margins following too vigorous cleaning of the teeth by the dentist with a stiff bristled rotating brush.

Another patient, with chronic suppurative periodontitis and pocket formation, developed a lateral root abscess between two molars with formation of a granuloma and a fistula. Slight trauma from food impaction resulted in prolonged bleeding very difficult to control.

The most dreaded hemorrhage, of course, is that following extraction, which often resists every attempt to control. The hemorrhage may occur externally in a continuous and copious amount so that the pillows and bedding are saturated. If an attempt is made to arrest the bleeding by packing the socket, by suturing the gums, or by pressure, the blood may seek channels into the tissue spaces and cause enormous swelling. One patient had the eyes swollen shut, the mouth held open and the tongue pushed out, with the neck and throat so swollen that swallowing and breathing were most difficult.[5] In Balyeat's second case, a similar complication developed. After extraction of a molar, the socket was packed to arrest hemorrhage, but bleeding continued under the pack and into the tissues of the neck. Pressure against the trachea resulted in fatal asphyxia.[6]

Even when hemophilia has been recognized from the past history or from the blood examinations, the occurrence of oral bleeding, either spontaneously or as the result of dental operations or injuries, may develop which will call for the use of all available knowledge to prevent or arrest hemorrhage.

Many procedures have been suggested for the treatment of these cases. As Birch states, tooth extraction should be avoided whenever possible, as, even with the greatest care, severe hemorrhage is liable to occur. If dental disease has progressed to such an extent that extraction becomes imperative, every possible precaution should be observed to safeguard the patient.

Calcium administration and the employment of animal serums and tissue extracts have been advocated for systemic

5. Birch, C. L.: Hemophilia, M. Clin. of North America, 17:364 (Sept.) 1933.

6. Balyeat, F. S.: Hemophilia—Short Review with Report of Two Cases, Pac. D. Gaz., 36:297 (May) 1928.

treatment.[7] Pickering used liver extract therapy, which he said lowered the coagulation time and controlled three cases of typical hemophilia.[8] Anaphylactic shock as a result of horse serum injection has been thought to decrease the bleeding and shorten the coagulation time as reported by Park[9] and Shore.[10] Diphtheria antitoxin has been used when horse serum was not available.[11] Antivenene had been used in several of our cases. Since snake venom may cause hemorrhage, it was reasoned that antivenene may check bleeding. Intramuscular injection of whole blood is a simple and valuable help. Transfusions have proved a life-saving procedure after other measures have failed.

Local treatment of various types has been advocated. Chemical styptics (iron salts and tannic acid) are frequently tried. Steadman believed that oil of turpentine had demonstrated its usefulness when packed with gauze in the sockets.[12] Tissue and glandular extracts (thymus and thyroid) applied directly to the gums have been used.[13] Topical application of the blood of the physician or of any other normal person to the bleeding site has seemed to hasten coagulation and to stop hemorrhage.[14] Application of packs with epinephrin has been advocated,[15] as well as local injections of epinephrin.[16]

Suturing has seemed to us of little help in arresting hemorrhage as the wounds from the needle puncture result in multiple bleeding points. Packing the sockets tightly with gauze, whether nonmedicated or medicated with styptics, appeared to be definitely harmful, as stated before, in that it did not materially check the hemorrhage, but diverted the extravasated blood into the tissues, causing extensive swelling and dangerous pressure on the trachea and esophagus.

One of our patients had several teeth removed by the use of an elastic band applied to the neck of the tooth. This constriction caused a slow separation of the periodontal membrane and the tooth eventually loosened and fell out. Irritation and soreness were not great and no excessive bleeding occurred. Evidently, the pressure from the elastic band resulted in anemic atrophy of the periodontal tissues. Cambrook[16] cited a similar experience of one of his cases.

We have found a valuable aid in the formation of a clot to be a molded splint, which may in emergency be made of modeling compound or guttapercha. The best results have been obtained from one made of vulcanite prior to extraction. This mold or splint should be so constructed that it fits accurately over several teeth on either side of the tooth to

7. Remarkable Case of Hemophilia—Report of Coroner's Case, Brit. D. J., 42:43 (Jan. 1) 1921.

8. Pickering, J. W.: Recognition, Treatment and Etiology of Hemophilia, Lancet, 1:1239 (June 15) 1929.

9. Park, L. W.: Hemophilia in Dental Surgery — Report of Case, D. Cosmos, 68:510 (May) 1926.

10. Shore: Abstr. Brit. D. J., 42:254 (March 15) 1921.

11. Bagchi, N.: A Case of Hemophilia, Brit. D. J., 43:20 (Jan. 1) 1922.

12. Steadman, F. St. J.: Use of Turpentine for Hemorrhage After Tooth Extraction, Brit. D. J., 43:299 (April 1) 1922.

13. Wright, Sir Almroth: Hemophilia, A Clinical Study, editorial, Brit. J. D. Sc., 64:3 (Jan. 1) 1921. Thesee, D.: Death Resulting from Natural Loss of Deciduous Teeth in True Hemophiliac, Rev. Stomatol. (January) 1922.

14. Leavitt, J. G.: Simple Method of Controlling Hemorrhage in Hemophiliacs, D. Rec., 41:613 (Dec. 1) 1921.

15. Friedman, R.: Hemophilia in Dental Practice, D. Cosmos, 67:873 (Sept.) 1925.

16. Cambrook, J. D.: Some Observations on Extraction of Teeth in Cases of Hemophilia, Proc. Roy. Soc. Med., 26:962 (June) 1933.

be extracted and covers the gum some distance beyond the operative field. This should be securely fastened in place by wire ligatures to sound teeth after the extraction. If the ridge would be left in an edentulous condition, the splint may be retained by pressure from the opposite jaw with the aid of a Barton bandage. This splint, or "hemorrhage arrester," as it has been called by Norman,[17] should be left in place for from ten days to two weeks. It has the function of permitting the clot to form without disturbance from the suction action in swallowing. It prevents the tongue and lips from loosening or dislodging the clot, and it holds the patient's blood in contact with the tissue fluids; which seems to favor clot formation. At times, it may be of value to line this mold with cotton soaked in ovarian extract, with the same object of stimulating coagulation.[5]

The plan of management that has been followed in dealing with the cases on Dr. Birch's service resolves itself into three phases:

First, an effort is made to increase coagulation by the administration of ovarian extract. This is given in rather large doses of from 60 to 100 grains daily for at least one week prior to extraction.

Secondly, knowing that the clotting time is sometimes shorter at certain times and that this variation occurs in periodic cycles, a favorable period for extraction is chosen when the clotting time is lowest. This required repeated coagulation testing.

Thirdly, a molded splint of vulcanite, as has been described, is made to fit over the tooth to be extracted and extending to include several teeth on either side of the site of operation and to cover the gum tissue for a centimeter or two beyond. Holes are drilled in suitable locations to allow the splint to be securely and firmly fastened in place after extraction by wire ligatures to the adjacent sound teeth.

No extraction is attempted until the clotting time is found to be twenty minutes or less. Extraction is accomplished with as little trauma as possible. The socket is not curetted, but loose granulation tissue is removed either at the apical region or from the periodontal area. As such tissue is more vascular and more loosely organized than sound gum tissue, it will bleed more freely, and therefore had better be removed. The molded splint is then applied with or without topical application of ovarian extract and secured in place. The splint remains undisturbed for from ten days to two weeks.

A soft diet is prescribed and the patient is instructed to remain as quiet as possible. A mild and warm antiseptic mouth wash is used. Surgical solution of chlorinated soda made with sodium hypochlorite does well. Some oozing of blood occurs under the splint, but usually is slight and rarely persists more than two or three days. After ten days or more, the splint is removed. The clot is found to have retracted and is quite small, dense and firmly attached. Epithelization over the surface of the clot is well developed.

The following cases illustrate some experiences encountered.

## REPORT OF CASES

CASE 1.—R. B., aged 4 years, whose birth was normal, with no bleeding from the cord, at 18 months cut his lip and bled for one week. Bleeding was checked by transfusion. At 12 months, he had bitten his tongue and bled for ten days. He had had two extensive hemorrhages into the thigh; also hemorrhages into shoulders, knees, elbows and ankles. An older brother, also a hemophiliac, bled to death after vaccination. A second brother, who is not a hemophiliac, had a cleft palate and harelip and was operated on with good result and no

17. Norman, H. H.: Dental Hemophilia, Brit. J. D. Sc., 64:18 (Jan. 1) 1921.

unusual bleeding. The patient's coagulation time on two determinations was one hours and twenty-five minutes, and two hours and thirty-five minutes. Under Dr. Birch's care and treatment with ovarian extract, the coagulation time varied from seven to forty-five minutes.

A lower left first deciduous molar was decayed well into the pulp chamber. A fistulous tract led through the buccal gum and ended in a papular swelling or granulation. Blood had been constantly oozing from this area for four days. The blood which accumulated in the mouth formed long strands, but showed no tendency to clot in lumps. Repeated applications of Monsel's solution (styptic solution of basic ferric sulphate) followed by the application of a modeling compound mold checked the bleeding.

At a subsequent time, the patient was seen bleeding from the tissues around the upper central incisors (deciduous). He had fallen and loosened these teeth, displacing the left one several millimeters out of normal alinement. A modeling compound splint was made by first fashioning a cup-like tray or trough of stiff aluminum metal to fit approximately, and then filling this with softened compound. This was applied and hardened in place by chilling. Undercuts around the adjacent teeth retained it fairly well and bleeding stopped shortly.

In April, 1934, the patient had another fall and knocked out the two upper central incisors. Blood oozed for about six hours, and bleeding stopped without the use of a splint or medicaments.

Case 2.—R. R., a member of a high grade hemophiliac family which was traced through seven generations, at 3 years of age bumped his head and developed a large hematoma. Many hemorrhages had occurred into the joints, especially the right knee and ankle, but also the left knee, both elbows, wrists, etc. Hemorrhages occurred with a febrile eruption, and many nosebleeds and subcutaneous and intramuscular hemorrhages had been experienced. The patient had had ten kidney hemorrhages up to 14 years of age. He was able to attend school only two years and received the rest of his education from his mother at home. He had regularly lost two or three months out of every year. From 7 to 10 years of age, he was in bed most of the time, while his deciduous teeth were shed. He was in a hospital for two years when his upper and several lower teeth were extracted. This patient was receiving ovarian and thyroid extract when admitted to the Research and Educational Hospital. His coagulation time at the beginning of treatment was about one hour. At one time, a low coagulation time of ten minutes was determined after he had been on treatment.

The last extraction was of a lower bicuspid. This bled for several weeks. A vulcanite splint was made to fit closely over the edentulous gums as there were no adjacent teeth. This splint remained firmly in place owing to close adherence and to undercuts in the residual ridge. Bleeding was quickly checked.

This patient later had four attempts made to fit him with an upper denture. The suction from impression taking caused bleeding into the palatal tissues resulting in a large hematoma of the posterior part of the hard palate, extending into the soft palate and down the pharynx and producing marked embarrassment to breathing and swallowing. The pressure from the edge of the dentures made it impossible to wear them, because of soreness and hematoma. After the patient had been on ovarian treatment for several months, the coagulation time was decreased to ten minutes. A compound impression was then carefully taken and a denture made, which proved satisfactory after a short period of adjustment. The taking of the impression and the presence of the denture itself produced some suction on the palatal tissues, but no bleeding resulted.

Case 3.—T. S., aged 40 years, at 18 months had fallen and cut his lip, which bled excessively. At 1½ years of age, a cut finger bled excessively. There were frequent and profuse nosebleeds up to 10 years of age. A tooth was extracted, Nov. 12, 1908, and bleeding continued for four weeks. The patient was in bed until February 26. For three months thereafter, he

was so weak that he fainted frequently. In 1910, a cut knee bled eight days, and the resulting subcutaneous hemorrhage incapacitated the patient for four months. He stated that, after cutting his thumb in 1911, he was "bled white," bleeding continuing two weeks. There were six known hemophiliacs in the family.

The coagulation time before treatment varied from eighteen to fifty-eight minutes. After treatment, Aug. 19, 1932, when the coagulation time was found to be fifteen minutes, a lower right first bicuspid with a putrescent pulp was extracted under conduction (procain) anesthesia. A modeling compound molded splint was applied. The socket was not packed. A moderate hemorrhage started two hours later, continuing for about ten hours. Then a loose gauze pack with ovarian extract was placed in the socket and the splint reapplied. This modeling compound splint fitted loosely and was moved by pressure from the lower teeth when the patient closed his jaws or attempted to eat, and therefore was not very satisfactory, but the hemorrhage soon stopped.

September 7, when the coagulation time was ten minutes, a lower bicuspid was extracted, and again a loose gauze pack saturated with ovarian extract was placed in the socket and a modeling compound splint applied. Moderate oozing continued for about ten hours and then ceased.

March 21, 1933, the upper left first bicuspid, which had a large granuloma attached to the root and a fistula draining through the buccal mucosa, was extracted. A close-fitting vulcanite splint had been made prior to the extraction. This was applied and secured by wire ligatures to the adjacent teeth. Only slight oozing for a few hours resulted. The coagulation time on this day was twenty-two minutes.

CASE 4.—F. B., a man, aged 65, had bled frequently in childhood from cuts and scratches. At 15 years of age, after a tooth extraction, he bled for a number of days. Since then, ten teeth have been extracted, with protracted bleeding on each occasion, except one extraction twelve years previously when he received numerous injections of horse serum intramuscularly. At this time, he bled from ten to fifteen days as he usually did on similar occasions, but the quantity was slighter. Twenty years ago, hemorrhoidectomy was followed by severe hemorrhage, resulting in extreme exsanguination. The patient stated that he "bled to death, but didn't die." This was followed by complete recovery and return to health. Three and one-half years previously, two left lower teeth had been removed and the bleeding was profuse for three weeks. Shortly after this, the right elbow was fractured in a fall, which broke both condyles and the olecranon and dislocated both ulna and radius. It was not a compound fracture, but there was extreme intramuscular, subcutaneous, and intracapsular extravasation of blood, resulting in a toxic state which lasted for a month, with eventual partial ankylosis of the elbow joint in flexion.

After both the hemorrhoidectomy and the last tooth extraction, the patient believed that trauma resulting from too vigorous packing was a factor in prolonging and increasing the bleeding. At times, injections of thrombin and thromboplastin have made no difference except to produce fibrin plugs at the site of injury. This also occurred after administration of horse serum. An intramuscular injection of whole blood on another occasion was also without effect. The patient finds that exertion or warmth increases bleeding. There have been no joint disabilities, tendency to bruise easily, melena, black stools, hematemesis, hemoptysis nor nosebleeds in youth. The local application of calf's brain suspension (probably thromboplastin) had been of no help.

In connection with the family history, there is a vague impression of ancestors related to the Hohenzollerns and to the Spanish nobility—both noted for their hemophiliacs. Two of the patient's brothers died of internal hemorrhage. There were no hemophiliacs on the father's side of the family.

One year prior to our seeing the patient, he bled for one week from the gum around a loose root which had been an abutment

for a long bridge. This area was packed with epinephrin and tannic acid gauze without effect. At that time, he was given daily injections of ovarian extract at the Presbyterian Hospital of Chicago under the supervision of E. E. Irons. The root was removed when the coagulation time was five minutes, with no untoward bleeding.

When the patient came in, Jan. 5, 1933, he was found to have a coagulation time of from thirty-five to forty minutes. After treatment, this decreased to from nine to fifteen minutes. It was decided to remove the roots of the upper left first molar, which had been separated by caries and were surrounded by hypertrophied mucosa. A vulcanite splint was made prior to extraction. The roots were extracted and a large granuloma was removed. The splint was applied and wired to adjoining teeth. Slight bleeding continued for about twenty-four hours and then stopped, but some intermittent oozing recurred from underneath the splint for about three days after extraction. The splint was removed, January 24, having been on fourteen days. The clot was found to have retracted into the socket. It was covered with firm epithelium, and no bleeding was seen. Although a small amount of food débris had adhered to the under side of the splint, there was no irritation to the gums or the retaining teeth.

January 31, 1933, the upper left cuspid was extracted and a large pyorrhea sac was detached with the root. Another splint was applied. Some oozing persisted for forty-eight hours, then ceased. The splint was left on for ten days, and the same good result was noted as with the previous extraction.

In all, extraction was successfully accomplished in a total of eight instances, with the same good results.

## COMMENT

In the observation and history of a rather large group of true hemophiliacs, bleeding from the oral tissues, either spontaneous or as a result of dental procedures, was found to be a frequent occurrence. The most serious of these hemorrhages and the most difficult to control were those following tooth extraction.

Satisfactory management of these cases was secured by observing the following plan:

1. Constitutional treatment: The administration of rather large doses of ovarian extract in an effort to stimulate coagulation.

2. A selection of the proper time for operation, i.e., when the coagulation time was lowest or in a remission phase of the periodic bleeding cycle, as determined by frequent and regular clotting time examinations. No extractions were attempted unless the coagulation time was under twenty minutes as determined by Howell's test tube method.

3. Local treatment:

(*a*) The application of a close-fitting molded splint of vulcanite covering the site of injury, which protects the clot and holds the blood in contact with tissue secretions.

(*b*) Local application of ovarian extract directly to the site of bleeding.

(*c*) A minimum amount of traumatization in removing the teeth.

Extraction was successfully accomplished in eight instances by observing this method of procedure, with no unusual bleeding.

# THE DENTIST IN THE MEDICAL CENTER

By FRED HERZBERG, D.D.S., Chicago, Ill.

WITH the rise and acceptance of the theory of focal infection and the resulting extension of cooperation between the medical and dental professions, it is of interest to note the rôle played by the dentist in the medical center. A medical center may be defined as an organization composed of members of the medical and allied professions under one supervision and in a single locality, having as its object the treatment of human ailments with a view to the effective cooperation of the various groups to this end. It is apparent that dentistry as an allied profession or as part of the medical profession must have some part in the medical center if it is to be complete.

To determine the position of dentistry in these institutions, a survey of the literature for the twenty years (1913 to 1933) was made. The Cumulative Index Medicus yielded a total of nine articles, all written since 1929; Black's Dental Index gave no returns whatever, and the indices of several libraries added no further materials. To the nine articles mentioned were added several letters received from the institutions involved in response to queries regarding dental information. Not a single one of the nine articles mentioned dentistry, except incidentally.

Many institutions throughout the country might be classed as medical centers and would therefore come within the meaning of this article, but only those that have been described in the current literature will be taken into consideration, as (1) they are more nearly typical of what our future medical centers will be, (2) they could obviously do more effective work than smaller institutions and (3) more information is available on their work. I shall consider here particularly the dental angle of the medical centers.

## COLUMBIA UNIVERSITY-PRESBYTERIAN HOSPITAL

The Columbia University-Presbyterian Hospital Medical Center in New York City is made up of the College of Physicians and Surgeons, Presbyterian Hospital, Sloane Hospital for Women, Vanderbilt Clinic, Neurological Institute and Babies Hospital,[1] to which may be added the School of Dental and Oral Surgery of Columbia University. They are all practically under one roof; which makes cooperation between departments comparatively simple.

Since September, 1928, the School of Dental and Oral Surgery has been housed in the Medical Center, where it occupies three floors and has a floor area of 40,000 square feet. "The Dental School Clinic includes as one of its functions the dental care of the patients of the Medical Center Hospitals."[2] There are at present 175 students enrolled at the

1. Darrach, William: Profession and Medical Center, New York J. Med., 29:579-580 (May 15) 1929.

2. Bulletin of Information, School of Dental and Oral Surgery, Columbia University, New York City, 1933-1934, p. 13.

school, and there are 133 dental chairs available in the clinic. Besides the students, there are also the dental faculty and the two dental interns employed by Presbyterian Hospital. All branches of dentistry are of course practiced in the dental school, which carries on diagnostic work for about 25,000 persons annually, a large percentage of which are patients referred by the Vanderbilt Clinic for oral surgery service.[3]

The Medical Center library contains 58,000 volumes, of which about 4,000 are dental.[3]

It is obvious from the foregoing facts that cooperation between the medical and dental professions is here possible to a very great degree. Dentistry, it is evident, plays a fitting rôle in the Center, especially so since dental students are brought into close contact with medical students and hospitals and are no doubt subjected to their fine influence. From an institution wherein dentistry is given such a fitting place of importance in the work of treating human ailments, we may expect to obtain good results for the professions concerned and for the people at large. Other institutions may well look to this Center as an example of timely cooperation between medicine and dentistry.

### NEW YORK HOSPITAL-CORNELL MEDICAL CENTER

The New York Hospital-Cornell Medical Center in New York City is probably the largest and most imposing of all institutions of its kind in the United States, if not in the world. It is housed in eleven buildings, the highest of which is twenty-seven stories, covers 6¼ acres of ground and has a daily population of 3,000. It has a general hospital, facilities for private patients, a woman's clinic, housing the lying-in hospital, children's clinic, psychiatric clinic, Cornell University Medical College, a school of nursing, solariums, out-patient department, accident ward, etc.[4]

It is interesting to note that in such a gigantic organization there are only six dental chairs and twenty-one dentists, as contrasted with tremendous medical facilities, 500 physicians and 495 nurses. Prophylaxis, radiography, plastic filling, root canal work and pyorrhea treatment are the only branches of dentistry practiced. Orthodontia and prosthetic dentistry are noticeable by their absence, as are also the use of gold inlays and ceramics. No dental interns are employed, nor is there any connection with a dental school.[5] There is a severe contrast between the approximately 3,600 patients seen yearly by the dental staff in this institution and the 25,000 patients examined and the 6,000 patients treated at the dental school of the first medical center mentioned.

### TULANE MEDICAL CENTER

The School of Medicine of the Tulane University of Louisiana and the Charity Hospital make up the medical center of New Orleans.[6] With the discontinuation of the work of the Tulane School of Dentistry, about 1927, a dental clinic was operated in cooperation with, but independently of, the general teaching clinic of the medical school. Since February, 1934, this clinic has been operated as one of the divisions of the teaching clinic of the medical school. The dental work car-

3. Rowe, A. T.: Personal communication to the author.

4. Sloan, R. P.: Vast New Medical Center Guards New York's Health, Mod. Hosp., 40: 49-56 (March) 1933.

5. Howell, Norman: Personal communication to the author.

6. Bass, C. C.: Plans and Functions of the New Hutchinson Memorial Building, New Orleans M. & S. J., 82: 645-647 (April) 1930.

ried on is composed solely of examination and diagnosis supplemented by only minor types of treatment. The library contains about 900 dental volumes. There are no interns.[7]

Dentistry may be said to be a negligible factor in the New Orleans Center. Little can, of course, be accomplished, under the circumstances mentioned, toward a better understanding between medicine and dentistry and for such closer cooperation as is necessary between the two for the benefit of the patient.

### ARMY MEDICAL CENTER

The Army Medical Center, Washington, D. C., has approximately seventy-five physicians, nine dentists and 140 nurses on duty. There are a total of twenty-five dental chairs at the center, of which seventeen are in the hospital and eight in the Army Dental School. With the exception of orthodontia, all branches of dentistry are taught at the dental school, and we may assume that these branches are all practiced at the hospital. The dental library contains 750 volumes. While there are no dental interns at the hospital, it is interesting to observe that postgraduate courses are furnished to officers of the Dental Corps, and selected enlisted men are trained in oral hygiene, dental mechanics and roentgenology.[8]

The Army Medical Center with its proportion of dentists to physicians and its evident interest in dentistry shows itself as a forward looking organization of the Army and as an aid to closer medicodental relationships. The Army Medical Center, which has had as a part of it since 1922 the Army Dental School,[9] is probably one of the first organizations of its kind to be so closely connected with dentistry.

### YALE UNIVERSITY

While I am uncertain whether the Human Welfare Group at Yale University may be classed as a medical center, I believe that sufficient interest has been shown dentistry to make it worth while mentioning Yale at this time. There is a dental clinic associated with the New Haven Hospital, with whose work I have not become acquainted. From the medicodental standpoint, there is something of much more interest at Yale. I refer to the Rockefeller scholarships (two) given yearly to a selected few young dentists, which enable them to carry on dental work at the New Haven Hospital, participate in dental research and at the same time study medicine. From this group of men will no doubt arise those who are to cement our relationships with the medical profession through their participation in both professions as teachers, research workers and clinicians. This mention of Yale may very appropriately be closed by a quotation from the dean of its medical school, who wrote: "The building scheme at the Yale University School of Medicine is thus in conformity with the desire to stress integration, rather than separation of all branches of biology."[11]

### CONCLUSION

We may conclude from this report that dentistry is playing a part, not so large nor as fittingly as it should, in the work of the medical centers, but nevertheless a part. We may also conclude that the

7. Bass, C. C.: Personal communication to the author.

8. Hawley, P. R.: Personal communication to the author.

9. Meehan, J. W.: The Army Medical Center, Clin. Med. & Surg., 37:883-887 (Dec.) 1930.

10. Dasey, M. K.: Personal communication to the author.

11. Winternitz, M. C.: Methods and Problems of Medical Education, 20th series, 1932, pp. 5-15.

seeds of medicodental cooperation have been sown in the centers and will without doubt grow as time, experience and knowledge compel further recognition of the necessity for correlation of the healing arts.

This article is not in any way intended as a criticism of any institution mentioned, but rather is intended to show, within the limits of the information I have been able to obtain, the status of the dentist in these institutions. I am aware that there may be perfectly valid reasons in some cases for failure to give dentistry a fitting place in the general scheme of the medical center. Since such reasons are not known to me, I have merely stated the facts to the best of my knowledge, and with no attempt at adverse criticism except by way of comparison, and to show the place of dentistry in the various institutions.

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# SOME VARIATIONS OF THE UPPER THIRD MOLAR*

By M. RUSSELL STEIN, D.D.S., New York City

PECULIAR shapes of third molars have always excited interest among dentists and anthropologists. As early as 1867, Dr. Webb, of England, described the variability of the third molar and speculated on its probable causes. In the "Descent of Man," Darwin comments on the tendency of the third molars of civilized races to become rudimentary. The problem is an old one, but with the more recent discoveries and researches in genetics, paleontology and statistics, the mystery stands a better chance of solution.

Third molars vary more in both size and form than do the other two molars. The coefficients of variation of the first, second and third molars of two large groups are listed in Table 1. The various sizes of second molars are more widely distributed than those of the first, and those of the third more than those of the second. This order seems to hold true for all races. The variability of size and the absence of third molars are

Fig. 1.—Upper molars; showing elimination of distolingual cusp.

*Read at a staff meeting at the Columbia University School of Dental and Oral Surgery, May 3, 1933.

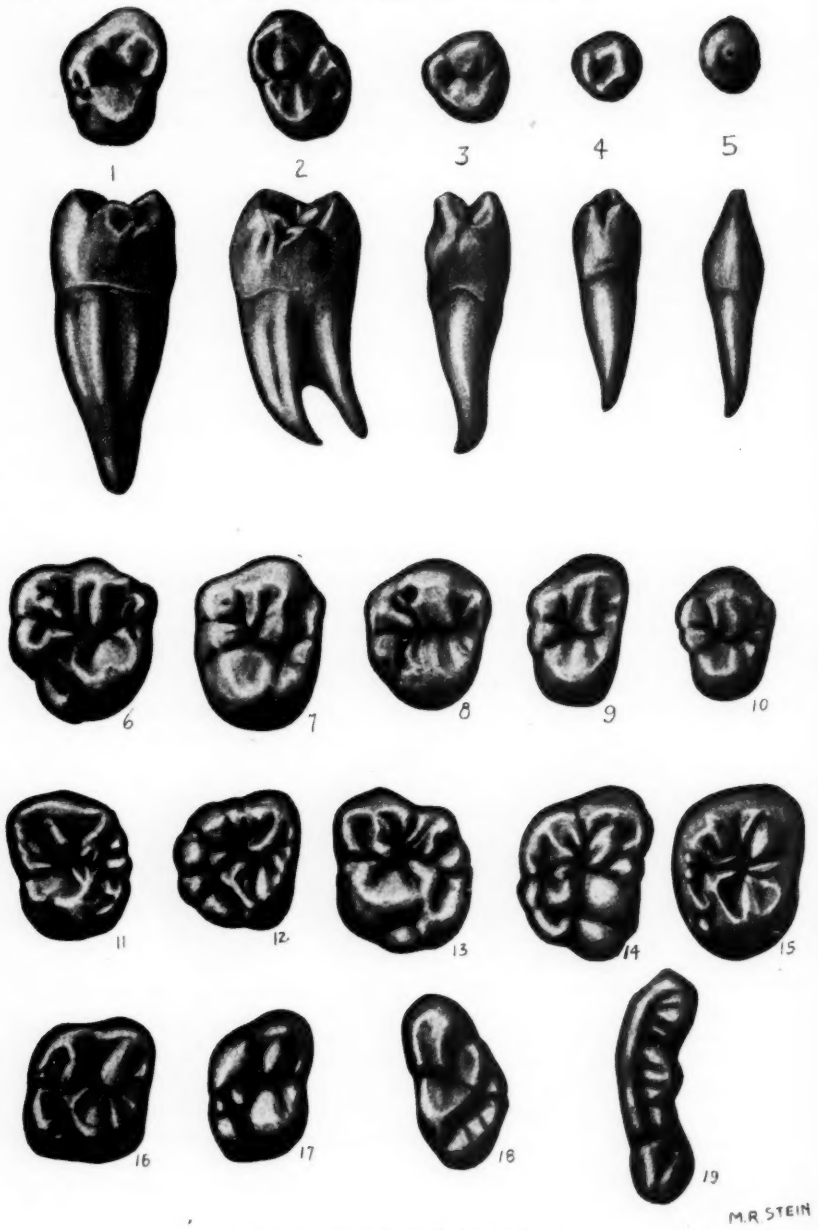


Fig. 2.—Diverse types of third molars.

phenomena independent of the dietary habits of the individual or the race.

Of the many theories that have been advanced explaining the cause and nature of the diversity of third molar patterns, the most popular is that which regards the variants as examples of reversion to primitive tooth forms. The casual comparison of modern third molars with those of lower mammals and fossils has led some to believe reversion too obvious a fact to be questioned. Certain observations relating to the most important of these examples of "atavism" point to other causative conditions.

Third molars range in form from a single conical stump to a highly complex multitubercular occlusal pattern with many elevations, depressions, prominent ridges and deep grooves. The triangular three cusped type and modifications thereof are the most common.

There seems to be a tendency in the human dentition toward the elimination of the hypocone (distolingual cusp) in second and third molars. (Fig. 1.) The total absence of this cusp leaves a trigonal pattern. The comparatively late acquisition of the hypocone in the evolutionary history of the human molar was stressed by Cope and Osborn.[1] Peculiarly enough, this cusp is the least stable in form and is the first to be lost in what appears to be a process of cusp reduction. The tricuspid molar has therefore been regarded as an example of "reversion" to the primitive tritubercular tooth. The same reasoning has been carried to the extreme in the instance of the conical third molar which supposedly reverts back to the reptilian cone. Similarly, the premolar analogy theory of Wortman,[2] which is a rival concept of the Cope-Osborn scheme, can be supported in the same way, for there are many modern upper third molars which so closely resemble second bicuspids that it would be difficult to tell them apart. Furthermore, from a reasonably large collection of human third molars, different specimens could be selected and arranged in such order as to prove almost any theory of the evolution of the human dentition. Such an argument assumes that this third molar phenomenon is an inverse evolutionary process recapitulating within the multitude of its diverse forms the history of the development of the quadritubercular molar. If this were true, one would expect the so-called reversion types to closely resemble the fossil forms of their supposed prototypes; the resem-

COEFFICIENTS OF VARIATION OF BUCCOLINGUAL DIAMETERS

| | Melanesians | | Mixed Whites | |
|---|---|---|---|---|
| | Number of Specimens | Coefficient of Variation | Number of Specimens | Coefficient of Variation |
| Upper first molar | 306 | 5.5 | 211 | 5.5 |
| Upper second molar | 300 | 6.7 | 206 | 6.6 |
| Upper third molar | 240 | 8.0 | 498 | 10.2 |

1. Osborn, H. F.: Evolution of Mammalian Molar Teeth, New York City: Macmillan Company, 1907.

2. Wortman, J. L.: Evolution of Molar Cusps is Mammals, Am. J. Phys. Anthropol., Vol. 4, 1921.

blance, in each instance, is vague and general.

The conical third molar is not homologous with the reptilian cone. It is an atrophic form resulting from the fusion of the three cusps of the tricuspid molar. In Figure 2, *1* to *5* represent a series of tritubercular third molars showing different degrees of fusion. Even in the extreme case of the conical tooth, a close examination discloses a depression at the tip of the crown indicating the last point of coalescence of the three cusps.

The ancient triconodont tooth with its prominent pointed cusps and cingulum is far from being the prototype of the modern third molar with the three cusps in a linear arrangement. Besides being vastly dissimilar in design, there is much evidence that this form of third molar is the result of anteroposterior compression due to a shortening of the maxillary bone. There are many facts about both posterior and anterior teeth which indicate the genetic determination of the mass of the crown. The shape can be altered by intraosseous pressures. Therefore, the last tooth to develop and erupt suffers most compression. This, at times, forces the metacone (distobuccal cusp) between the protocone (mesiolingual cusp) and the paracone (mesiobuccal cusp). Various degrees of this compression are illustrated in Figure 2, *16* to *19*.

In Figure 3, a second bicuspid is compared with a bicuspid-like third molar. They correspond cusp for cusp, ridge for ridge and groove for groove. There could be no better material for the speculative anatomist to prove Wortman's theory of the bicuspid origin of the tritubercular form. *6* to *10* in Figure 2 have corresponding lobes and, as has been suggested by M. Diamond, the chief factor in the variability of tooth forms is the proportional overdevelopment or underdevelopment of these primary parts. Other variations are illustrated in *11* to *15*. A large number of modern third molars evidence the tendency to become similar to the bicuspids, particularly the second bicuspid, which itself is being differentiated from the first by the acquisition of some molar characteristics. In a recent paper read before the staff of the dental school of Columbia University, W. K.

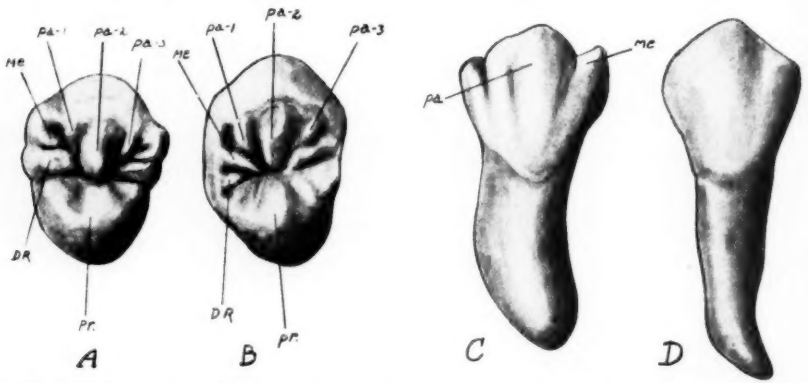


Fig. 3.—Comparison of bicuspid-like third molar and second bicuspid. *A*, occlusal view of upper third molar. *B*, occlusal view of upper second bicuspid. *C*, buccal view of third molar. *D*, buccal view of bicuspid.

Gregory suggested that the explanation for this tendency must be sought in the laws of ontogeny and heredity. He also pointed out that in many families of fossil and recent mammals, this tendency brings about a convergence in tooth form of different units of the series.

There is little doubt that the teeth of man are being dedifferentiated; that is, the characteristic features of incisors, cuspids, bicuspids and molars are becoming less distinct and their forms are being fused. This phenomenon also accounts for some of the so-called reversion types.

The reversion theory may be regarded as another example of the fallacious practice of inferring evolution merely from recent structures in single instances.

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## EDITORIAL OBSERVATIONS AT THE ST. PAUL SESSION

By NEWTON G. THOMAS, M.A., D.D.S., Chicago, Ill.

FOR blocks from the convention center, St. Paul had advertised its welcome to the dentists of the nation. The usual card was in every window and a florist had woven a map of America in immortelles and capeflowers with cordial hospitality lettered around it. This, too, in the profession's chosen shades. To make the citizens mindful of the dental guests and to awaken esteem for the history of the profession, the first dental license issued in Minnesota was displayed. Its date was 1881. The licentiate was Dr. T. H. Jacobs. Nearby was a dental chair of 1883, and beside it a cable, foot driven engine, bespeaking dental antiquity. These items were in proximity with an office equipment of latest design, a pointed portrayal of progress; but one lingered the longer before the relics of other days in appreciative reminiscence of the men who wrought successfully with the poorer tools, their skill and integrity giving efficiency to their inferior implements. Also, it was remembered that the engine is not so far out-moded. It lingered in some schools until the middle teen years of this century and still does service when power is not available or when emergency demands the unusual.

A *bon mot* coined on Monday was "The program is one-half over although it has not begun." This was in observation of the special groups that convened through Saturday and Sunday. There were meetings of editors, surgeons, prosthetists and others of segregate, personalized interest. The enthusiasm of such groups speaks well for the constituents themselves and for dentistry, but they leave an aftermath of wonder. The inspiration of such gatherings is needed over areas it does not reach. And for obvious reasons cannot. Time and cost mean much to those who plan to attend the convention. They cannot afford the added days and have a feeling of ineligibility to the special sessions. They lose the high notes struck by the exclusive preconvention sessions. When the papers and discussions are printed, they again lose influence and range because of the variety of dental publications, the irregularity of distribution and the absence of personal delivery.

This suggests the complicated schedule

of the meeting itself—not a new suggestion. The simultaneous addresses and clinics that have become an apparent necessity irritate and discourage. A sense of futility seizes anyone who desires to see and hear the best. He can't divide himself, and publication is so slow that he becomes impatient. He wants what is to be had when it is given. That is why he is there. A general practitione is interested in general dentistry. All it is his domain. So, when this group segregates and another withdraws, he is cheated. And, be it known, the nearer the general practitioner trails the specialist, the better for both. That cannot be gainsaid. Meetings have grown, overspread a wide area of time, and thinned in spots in consequence. This has been thought necessary. It might be worth while to think again. The genius that has made the meetings great can make them good. The process might be difficult, disappointing, disrupting for a time, but it is desirable. It would call out good sportsmanship, magnanimity, make the high places of service really high, and would truly educate.

The editorial groups alone may be exempt from the last made suggestion. Their trade is technically of no interest to men at large save as it sometimes impinges on an ego by advising change or rejection. But these little stings are not often felt by our literati, so generous are our present journals. These groups have assumed responsibility for a better dental journalism. They would encourage new, young editors to better writing, clearer thinking, wider vision. They aspire to raise the advertising page to the professional level, they dream of teaching contributors a better, clearer, more expeditious expression. They would advocate open statement, free discussion, assertion of fact, encourage publicity far beyond present practice. They would work on the theory that publicity is the breath of life to democracy. They have assumed a big job.

Interesting suggestions came to the surface. One was a consolidation of weak journals, leaving one to cover a larger area with greater dignity and more strength. Another was the dispensing of advertising from the Central Office to give it validity and a wider field. Also, consolidation to bring essays, treatises and research to print with greater speed, with a distribution commensurate with requirements. Still more, the editors of such publications would of necessity be chosen with a keener eye to fitness. The job itself would appeal to a man's pride and zeal. He would have something to give himself to and would make the gift whole-heartedly. A deciduous, an annual editor is no editor. But as long as our society publications fall as the leaves with each frost, editors must fall with them.

These editorial groups regarded no journal as too august to be criticized or condemned. The Journal of the A. D. A. was not exempt. These self-appointed arbiters did not hesitate to point toward it critically. And THE JOURNAL should not be exempt from criticism. THE JOURNAL does not ask to be free from it. But certainly, in its domain, it should be, if not peerless, the best that thoughtful openmindedness can make it. It should be free from remediable blemish, an example of professional idealism, a model of professional journalism.

A noticeable seriousness pervaded the entire convention. Perhaps the intimacy of the House of Delegates with the halls and lobbies or the closeness of the Board of Trustees was the cause. The day long sessions of these bodies deliberating on the major issues of dental and associational life could not help affecting the general tone. But seriousness was brought to the meeting. On the way to a Sat-

urday session, a visitor said, "I feel that it will be an important meeting." Seriously the men attended the sessions and equally so the leaders conducted them. Despite the salutary greetings and comments heard every minute of each day, long thoughts were expressed as commonly as the shorter ones. Socialized dentistry gave thoughtful moments to many. They sought answers terse and assuring. Economics, complex and perplexing, formed the substratum of talk as did war twenty years ago. What is the A. D. A. doing about it? The agencies of the organization and their particularized endeavors. Explanation of silence was asked or praise for accomplishments given. What is being done by the A. D. A. for the nonmember dentist? And so on, endlessly.

The nonmember dentists! Thoughtful members asked questions about them repeatedly. Those men form a large part of American Dentistry, for which the A. D. A. stands, responsibility for which the A. D. A. cannot avoid. If a high ideal demands of a doctor to serve when need calls, a like ideal asks the A. D. A. to serve these unassociated men. They are not all nonmembers from choice. Misunderstanding, misinformation, lack of information, financial stress, indifference are among the reasons for their failure to identify themselves with organized dentistry. And the only sources of information offered them are nonofficial, unauthenticated. Their journalism carries an oversaturation of silt, costly and deceptive. Free literature is all they receive, free, forsooth, that begins with "Buy!"—and ends with "Pay." We argue that they receive benefit of legislation and protection from organized dentistry! True. But saying to a citizen "You have the Constitution, Army, Navy and police" is not enough to make a good citizen. Government must come closer, be more intimate, be felt in warmer relationship. To the organization, these men would mean weight of opinion, force to new enterprise, power to all necessary endeavor. Indifference to them must have meaning to the Association.

There was seriousness in the intent of the convention. The program gave evidence. The guest speakers, chosen because of their specialization in vital dominant issues, the time given those issues by the ruling bodies of the organization inspired by the president's address, proved it. A thoughtful atmosphere was inevitable. To put the impression into a practical phrase, American dentistry is conscious of its place in world affairs. It knows its function to protect and conserve the private interests of its constituency; and more: it knows that it must aggressively serve. The Association can't wait for circumstance to thrust its problems forward when they are well nigh unsolvable, but must anticipate them before they have become too mature. A great organization was measuring its strength, had sensed its place in the world. The Association is no longer a handful of men absorbed by small affairs within small horizons, but a great body that perforce must assume great responsibilities. This it willed to do—and that determination pervaded the place.

The doings of the A. D. A. were given wide publicity. The local press gave columns to it daily. National journals quoted the climaxes of the addresses made. The importance of these things cannot be overlooked or overstressed. Dentistry is listed as a social force, a power capable of great purpose and great consequence.

These facts constitute a strong appeal to the professional pride, the personal ambition, the conscience of every dentist in America. They ring like a call to arms

to the man who has eyes to see and ears to hear.

The auditorium presented a vast panorama to fill the eye as lectures and debates had filled the ear. The large range of mechanics in dentistry gave play to a thousand ingenuities. Some of it will doubtless be swept up and discarded in a brief while, but the best of it will last, to improve with the years. And essential things constituted the most of it.

Two sides and more of the great enclosure were devoted to scholarship, to science, the product of schoolroom and laboratory and surgery. Material and instruments that a few years ago were seen and understood only in secluded places were on popular display. Photomicrographs, microscopes, lesions in wax, gross specimens, surgical procedures were set for easy observation. Men by the hundred stopped to examine. Hands long out of school made adjustments of microscopes as though in easy practice. A silent panoramic comment was evolved on the interest and intelligence brought to the displays. It seemed that not long hence the sciences once so cloistered would outstrip the enameled mechanisms in their attractiveness. In the stead of packages loaded into market bags, ideas, long-lived impressions, facts were garnered as the best gifts to be had.

An eavesdropper to comment before the display of the Association's Council on Dental Therapeutics heard the four different accents of the commonwealth there. These visitors talked freely to one another. No one feared an argument. Each spoke as though there could be no dispute. "That is a great work." "It is the best thing the A. D. A. has ever done." "Dentistry needs that." "Every journal in America ought to support it." And thus on and on. A listening stranger meant nothing. He was welcome to hear. They voiced their faith. And he was hearing the "voice of the people." By the score, they bought the first issue of "Accepted Dental Remedies." They were part of a crusade. Their simple clipped sentences formed what should be irresistible encouragement. Hours of listening proved that these men were serious. It was a serious convention.

# PERIAPICAL OSTEOFIBROSIS WITH FORMATION OF CEMENTOMA

By EDWARD C. STAFNE, D.D.S., Rochester, Minn.

THAT cementoma has been considered a rare finding in man can be accounted for by the fact that these lesions remain relatively small and are almost always symptomless. Without the aid of the roentgenogram, most of them would remain unrecognized. A more general use of the complete dental roentgenographic examination, which is indicated from present tendencies, will undoubtedly disclose cases in sufficient numbers to place the cementoma among the more common tumors of the jaw. Although it is difficult to determine the

*From the Section on Dental Surgery, The Mayo Clinic.

*Read before the Section on Histology, Physiology, Pathology, Bacteriology and Chemistry (Research) at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 9, 1934.

exact incidence, an approximate estimate can be made. A complete dental roentgenographic examination of 10,000 consecutive adult patients revealed twenty-four cases of cementoma, in which a total of fifty-two teeth were involved. Prior to the examination, some of the patients may have had cementomas removed on the assumption that they were simple granulomas, calcified granulomas or early radicular cysts. There are a few instances in which they remain very small, and radiopacity varies so little

four were found in edentulous areas. The mandibular teeth with which the growth was associated were: incisors, 106; bicuspids, eight; first molars, five; cuspids, three; and third molars, one. The maxillary teeth were: lateral incisors, five, and cuspids, two. It will be noted that 106, or 81 per cent, were mandibular incisors. The total number of teeth involved by cementomas were: the mandibular, 123, and maxillary, seven; a ratio of more than 17:1. In one case, the nine teeth involved were all situated in the mandible.

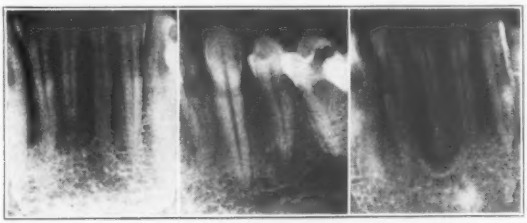

Fig. 1.—Three cases of cementoma in the early stages.

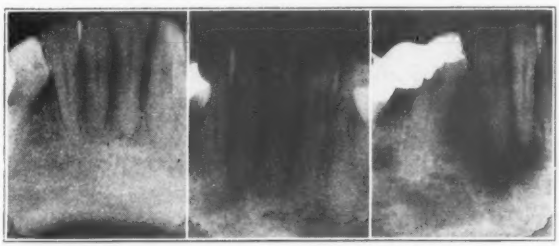

Fig. 2.—Roentgenograms taken in: *a*, 1929, negative; *b*, 1932, slight evidence of activity; *c*, 1933, large area of radiolucence.

from that of the surrounding bony process that the roentgenographic diagnosis is uncertain. One can, therefore, assume that the incidence is at least 2.4 per thousand persons.

In sixty-five cases observed, including thirty-five which have been reported by me,[1] there were 130 teeth involved, and

That each patient usually had more than one tooth affected suggests an individual tendency or predisposition. It will also be noted that while the majority affected were anterior teeth, there were no maxillary central incisors associated with such a growth; which is of interest when one considers traumatic injury as a possible etiologic factor. Those found in edentulous spaces were: one near a mandibular incisor, one near a mandibular bi-

1. Stafne, E. C.: Cementoma: Study of Thirty-Five Cases, D. Survey, 9:27 (July) 1933.

cuspid and two near a mandibular molar.

In no instance was pain present. All teeth, as far as could be ascertained by test, were vital, with the exception of two that contained fillings in the root canal. There were few teeth with fillings involved, and no active caries was found. No unusual or abnormal occlusal or incisal stress was noted. Mandibular incisors which had never been in occlusion were involved in one instance.

The ages of the patients ranged from 20 to 62 years; the average age was 42½ years, approximately that of all patients seen in the section on dental surgery. Seventy per cent of the patients were women. Complete general physical examinations revealed a wide variety of systemic conditions, such as one would expect to find among patients who present themselves at a medical clinic; but the findings suggested no association of cementoma with any one particular disease. There were no cases of hyperparathyroidism that could account for fibroid degeneration of bone.

There are three typical pictures in the roentgenograms, depending on the stage of development at which the tumor is seen. The first is the one seen in the early stage of development, in which the area affected casts a radiolucent image on the roentgenogram. It is this picture that causes most confusion in diagnosis and from which most misinterpretations arise.

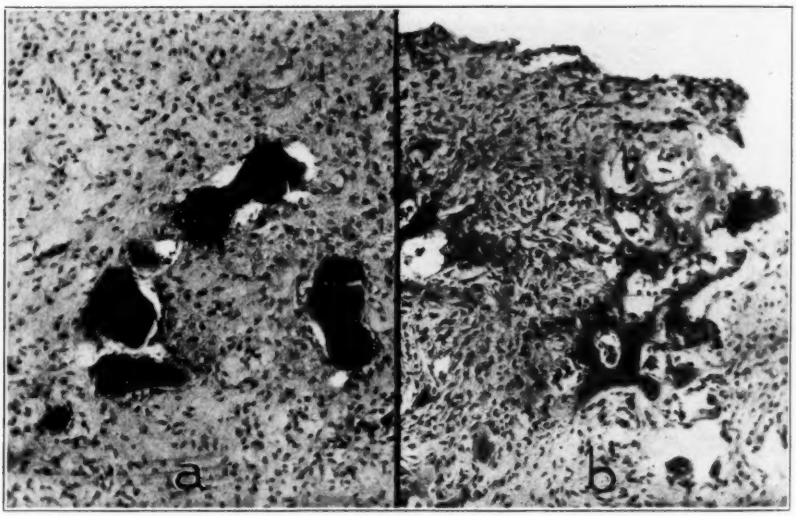


Fig. 3.—*a*, inner zone; cementicles developing in connective tissue, with some in the process of fusion. *b*, peripheral zone; bone spicules in connective tissue.

Cementomas are invariably diagnosed as areas of periapical infection or radicular cysts, according to the size of the area affected. The presence of radiolucent areas on a tooth of normal color and a positive vitality test, with no history of injury or pulpitis, should suggest that one is dealing with this type of growth, particularly if the tooth involved is a mandibular incisor. Roentgenograms taken in the early stage in three cases are shown in Figure

1. It will be noted that the areas extend well up on the sides of the roots of the teeth and that they are not quite so radiolucent as those of the average granuloma. Development is frequently attended by hypercementosis of the roots of the teeth involved (Fig. 1*a*). It is doubtful that resorption, as is often observed in association with periapical infection, ever occurs. There is no hypercementosis discernible in the roentgenogram of the first bicuspid involved (Fig. 1*b*). In Figure 1*c*, it will be noted that a small portion in the center and near the apex is becoming slightly radiopaque.

A case which illustrates the early stage very well is shown in Figure 2. There was some evidence of activity in the roentgenograms taken in 1932, and a

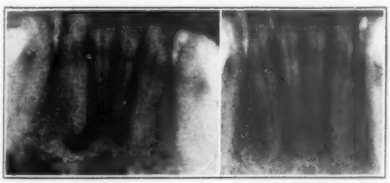

Fig. 4.—*a*, early stage. *b*, four years later. Decrease in size of radiolucent area may be noted.

large area of radiolucence had appeared one year later that resembled a radicular cyst. The patient, a woman, aged 38, was afflicted with myositis. In view of the general systemic condition and the close roentgenographic resemblance of the growth to a dental cyst, removal of the teeth involved was advised, although there had been no pain associated with the development of the suspected area, and the teeth appeared to be vital. When the teeth were removed, it was found that they contained normal pulps, and no growth was obtained from cultures taken from the round mass of tissue enucleated. Microscopic examination revealed a solid growth composed chiefly of connective tissue. In the inner zone, cementicles were forming in connective tissue and some were in the process of fusion with others (Fig. 3*a*). There were bone spicules in the peripheral zone, but no cementicles were present. There was active osteoclasia and also evidence of formation of new bone (Fig. 3*b*). The presence of bone spicules in the peripheral zone may explain and account for the reduction in diameter of the radiolucent area as seen in the roentgenogram. A marked reduction in size, once deposition of cementum has begun, has been noted in several instances. This filling in at the periphery is roentgenographically normal alveolar bone (Fig. 4).

Fig. 5.—Typical appearance of cementoma in the stage in which it is often erroneously diagnosed as calcified granuloma.

2 The second picture, which is roentgenologically typical of cementoma, is that seen when sufficient cementum has formed in the central zone to produce a radiopaque image within the original radiolucent area. Dewey[2] reported such a case in which a mandibular incisor was involved, and made a thorough and interesting study of it from a histogenic standpoint. Blum[3] reported one in which a cementoma was associated with a man-

2. Dewey, Kaethe: Case of Genuine Cementoma, J.A.D.A., 18:2052-2063 (Nov.) 1931.

3. Blum, Theodor: Clinical Oral Surgery, with Special Emphasis on Its Related Pathology, J. D. Res., 10:337-365 (June) 1930.

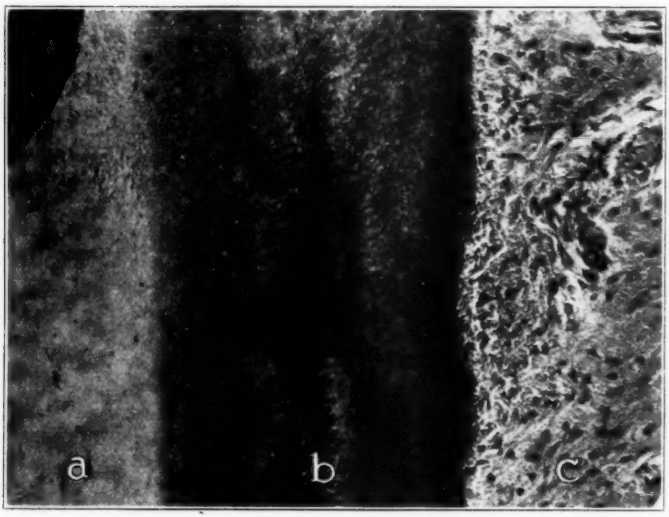


Fig. 6.—Relation of growth to root of tooth: *a*, dentin; *b*, thickened root cementum; *c*, connective tissue.

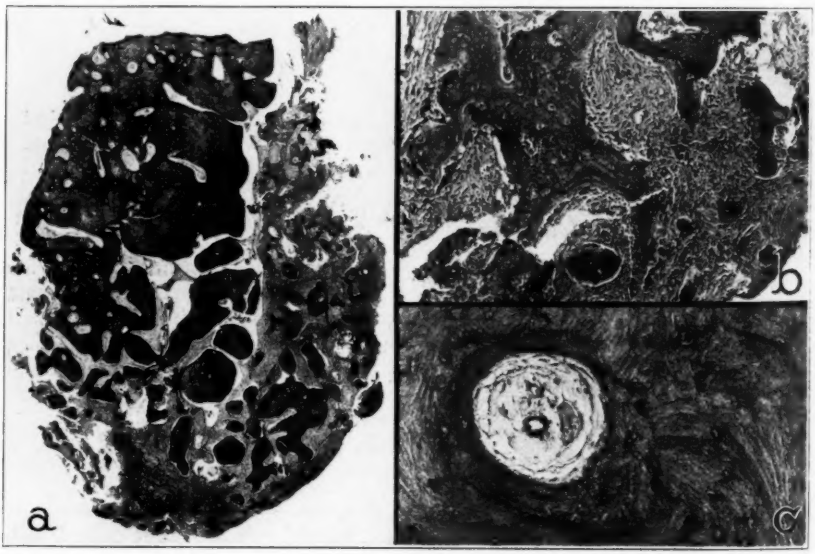


Fig. 7.—*a*, cross section of entire mass. *b*, peripheral zone; vascular connective tissue with cementicles and bone spicules. *c*, inner zone of compact cementum with marrow-like space.

dibular first molar. No doubt a large number of these tumors have been diagnosed and referred to as calcified granuloma. To one who has seen and has become familiar with cementomas, such a picture should offer no difficulty in diagnosis. A case reported by me illustrated this stage of development of the tumor very well from a histologic, as well as from a roentgenologic, standpoint. This cementoma was obtained incidentally to

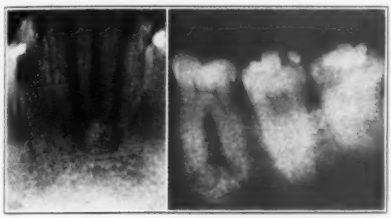

Fig. 8.—Two cases of cementoma in quiescent or mature stage.

normal. The growth was somewhat elliptical and rather hard and rubbery. Its surface was fairly smooth. Microscopic examination disclosed a mass containing connective tissue, cementum and a few bone spicules (Fig. 7*a*). In the peripheral zone, where connective tissue is predominant, several bone spicules were present, and there were single cementicles, a few of which were in the process of fusing with others, demonstrating active growth (Fig. 7*b*). In the inner portion of the mass, fusion of cementicles had taken place to form an area of fairly compact cementum (Fig. 7*c*). There was nowhere evidence of an infectious or inflammatory process.

(3) The third typical picture is that of the quiescent or mature stage; if we assume that one can consider such growths are becoming totally inactive (Fig. 8). Two cases have been observed in which there

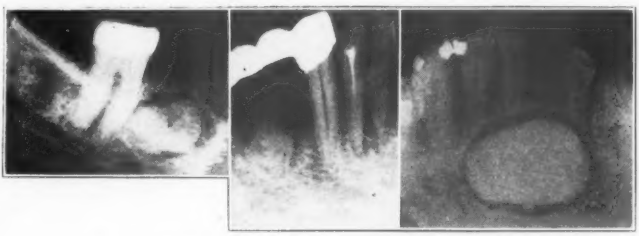

Fig. 9.—Three cases of cementoma in edentulous areas.

the removal of four mandibular incisors (Fig. 5). The labial alveolar process was removed to facilitate enucleation, and the growth was removed with its attachment to the root of the tooth undisturbed. The relation of the growth to the root may be noted in Figure 6. The cementum is cellular and thickened, although there is no evidence of this in the roentgenogram. The patient, a woman, aged 35, had had no local symptoms and was unaware of the presence of the growth. The pulp of the incisor to which it was attached was has been no evidence of change in the roentgenogram in seven years, and Frank[4] has had under his observation for eleven years one in which the mandibular incisors were involved, but in which the cementoma had not increased in size during that period. The most noticeable feature in the roentgenogram is the narrow, fairly even band of radiolucence that immediately surrounds the radiopaque mass, which has at this stage al-

4. Frank, Leonard: Personal communication to author.

most completely filled the original radiolucent area. This feature alone distinguishes cementomas from osteosclerotic areas, as is illustrated in those found in edentulous areas (Fig. 9). The outline is rounded, regular and well defined; which suggests that the tumors have been allowed to develop in all directions without interference from the root after removal of the tooth. The dense mass is not firmly attached to the surrounding bony process, and surgical removal is made with ease, if a sufficiently large opening is made through which it may pass. Microscopic examination reveals that the mass is predominantly compact cementum, which has formed from the fusion of cementicles. There are few single cementicles, and there are no bone spicules (Fig. 10*a*). Attached to the periphery are remnants of the connective tissue (Fig. 10*b*), which accounts for the radiolucent band that is in evidence in the roentgenogram. Calcified substances composed of cementum and bone rarely, if ever, unite, but remain separated by a layer of connective tissue.

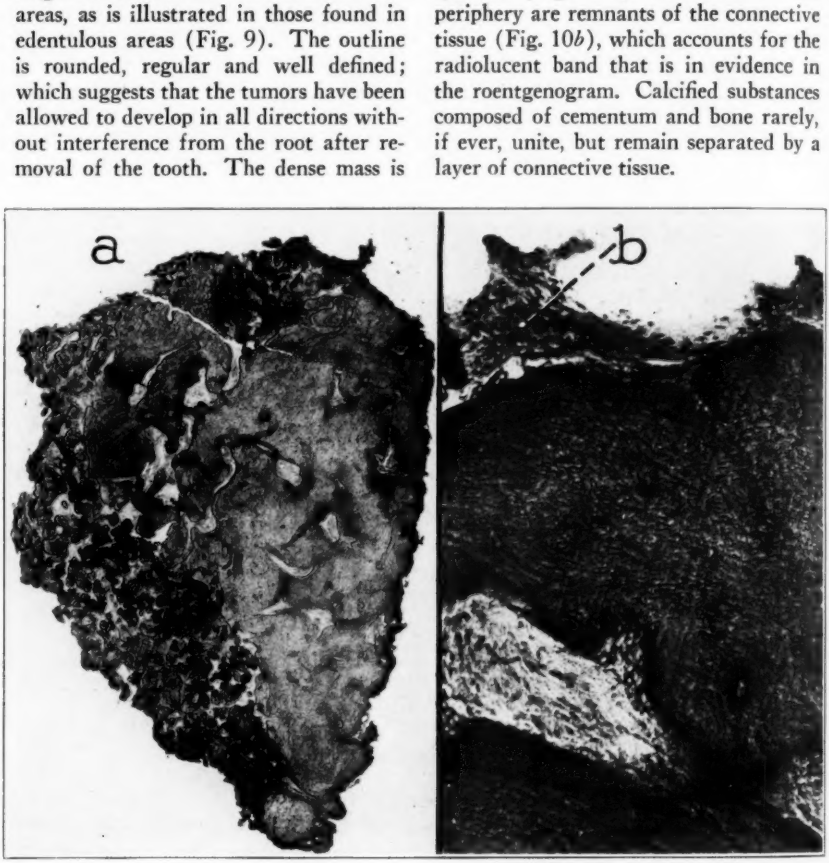


Fig. 10.—*a*, cross-section; predominantly compact cementum. *b*, connective tissue attached to periphery.

COMMENT

Cementoma, particularly in the early stages of development, presents roentgenographic evidence in many respects similar to that seen in dental granuloma. One should keep in mind that every radiolucent area at the apex of a tooth is

not necessarily evidence of periapical infection. It is possible that radiolucent areas which sometime appear and remain for a relatively short time are due to a localized periapical fibroid degeneration. The fibrous tissue may not produce bone-like cementum, but may again be replaced by normal alveolar bone, with the result that there remains but slight, if any, roentgenographic evidence. In this connection, a case reported by Blayney two years ago has been of special interest to me.

As regards the diagnosis of radiolucent areas about root apices, I wish to call attention to a very interesting case I had this summer. The patient, a woman, aged 50, complained of arthritis. The physician suggested mouth examination. Roentgenographic study disclosed a small radiolucent area about the apex of a lower central incisor. Clinical examination of the tooth was negative. The physician insisted on the removal of the tooth. The patient also thought the tooth was the cause of the arthritis. As the last resort, the dentist carefully removed the tooth, placed it in solution of formaldehyd, and sent the tooth to me for histologic study. The findings were interesting. The pulp was normal throughout. The root-end did not show evidence of past or present resorption but, quite the contrary, a hyperplasia of apical cementum. The small mass of soft tissue attached to the apical cementum at a considerable distance from the foramen was found to be very cellular but entirely free from all inflammatory cells. These cells were like young fibroblasts with very little intercellular substance. There were many areas of hyalination, some of which were undergoing calcification. The entire picture in every respect resembled that of a fibroma and not that of an inflammatory reaction.

Whenever the clinical findings disagree with those of the laboratory, those of the clinic should be accepted.

There were no microscopic sections shown, but, from the excellent description given, one is inclined to believe that Blayney[5] may have been dealing with a cementoma in the early stage of development. The areas of hyalinization referred to may have been cementicles. His suggestion that one should accept the clinical rather than the roentgenographic evidence, when such findings disagree, is a timely one. Simpson[6] has recognized for some time that periapical areas of radiolucence may appear that are not due to periapical infection.

## SUMMARY AND CONCLUSIONS

The occurrence of cementoma in man is not so uncommon as formerly supposed. The opportunity to observe several cases of cementoma during the formative period has made it possible to illustrate three typical or classic pictures, within which range a cementoma will manifest itself, according to the stage of its development. They are significant only in that misinterpretations arise. The growth usually remains relatively small. The teeth affected invariably remain vital, and removal is rarely justifiable, particularly if it involves the devitalization or loss of vital and healthy teeth.

5. Blayney, J. R.: Correlation of Preceding Papers with Diagnostic Deductions, J.A.D.A., 19:765-768 (May) 1932.

6. Simpson, C. O.: Personal communication to author.

# PRESENT STATUS OF KNOWLEDGE CONCERNING MOVEMENT OF THE TOOTH GERM THROUGH THE JAW*

By ALLAN G. BRODIE, D.D.S., Chicago, Ill.

DURING the past five years, I have been obliged to study the growth and development of the human head from all the angles from which this problem has been attacked. I have been especially interested in the relation of of this growth and development to the teeth. Reading the various authorities, it has been borne in on me that tooth investigations are ignoring general growth phenomena and the growth investigations are taking little heed of the teeth except from a symptomatic standpoint. This is unquestionably due to differences in the methods employed. The purpose of this paper is to call to the attention a few apparent inconsistencies and, if possible, to attempt an explanation of them. The two fields with which I propose to deal concern eruption and growth of the face.

Eruption has been generally conceded to be a growth phenomenon, and yet when we study the work of the various dental histologists, we realize that they are primarily interested in tracing the growth and development of the individual tooth germ. While they may vaguely refer to the growth of the jaws, most of them start from an embryologic point and describe the dental lamina, buds, papillae, crypts, etc., up to the complete calcification of the crown. Then, we are introduced to a process called eruption. This term is not very well defined, but, by most investigators, it is apparently considered to be the emergence of the tooth into the mouth, although others consider that it starts with the opening of the crypt and the emergence of the tooth therefrom. As to what incites this particular activity and by what mechanical or physiologic means it is continued through to completion, we are in the dark. There have been and still are several theories of eruption. A brief review of them is indispensable for the purposes of this paper.

Hunter, Magitot, Nasmyth, Kölliker and others believed that elongation or the growth of the root was responsible. In 1854, Kölliker wrote: "By the beginning of eruption, the crown is formed but the root is still growing. The germ therefore grows in length and is pressed out by dentine formation against the roof of the alveolus." A more modern authority implies a belief in this same factor. Orbán asserts that Hertwig's epithelial sheath is concerned not alone in the formation of enamel but also in the laying out of root form, and that this sheath becomes separated from the coronal structure and remains at the tip of the root. He states further that the sheath does not grow into the depth of the bone as some have said, but constitutes a relatively fixed point during the development of the teeth. The evidence he offers in support of this conception is a series of measurements made between the epithelial sheath and the floor of the nose, the relation between which, he says, remains constant. This would indicate that eruption of the

teeth is a matter of elongation of the root.

Zuckerkandal, Walkoff, Eidmann, Noyes and others have advanced the second theory; namely, that of pulp pressure. Oehrleim explains this force as an intermittent alternating activity of cells, cell divisions and pulsating blood vessels between the tooth and the floor of the alveolus, the roof of the crypt being removed by pressure atrophy. This theory is stated by Noyes as follows:

The force exerted by the growing tooth is the result of the multiplication of cells in the tooth germ, and is exactly comparable to the forces exerted by multiplication of cells in any position. For instance, the force exerted by the multiplication of the cells in a rootlet of a plant is sufficient to force pebbles aside and make an opening through hard packed earth. How this force is generated has been a matter of much speculation and investigation. It shows some points of similarity with the swelling of wood fibres when water is added. It apparently is related to osmosis, and has direct relations to blood-pressure. It is certainly a very complicated matter, with chemical affinities at the bottom of it.

Usually somewhere between the seventh and ninth months after birth the growth of the central incisors causes the absorption of the roofs of their crypts, and the tooth moves occlusally, cutting through the soft tissues. The formation of cementum on the surface of the root and of bone on the wall of the crypt attach the connective tissue fibres and form the beginning of the peridental membrane. As the tooth moves occlusally the bone grows up around it from the circumference of the crypt wall, converting it into the wall of the alveolus. The root is not fully formed and the conical pulp filling the funnel-like end exerts force by the multiplication of cells and the blood-pressure, which cause the tooth to move occlusally and the bone to grow in that direction.

Still another theory is advanced by Gottlieb, who calls attention to the deposition of cementum on the surface of the root. This relates more to eruption for purposes of adjustment to wear of the teeth with age. It is interesting to note that this author pays little attention to eruption up to the time that the tooth breaks through the gum, and its subsequent activity he divides into four stages of eruption, which cover the entire life cycle of the tooth. Eruption, according to Gottlieb, never ceases.

A few investigators, Brash in particular, look on the teeth as passive rather than active agents in the process of eruption. Brash feels that eruption starts with the formation of the crypt and is continued by the growth of alveolar bone. This point of view will be enlarged on later.

Demolis, who has done an outstanding piece of work on the problem of eruption, sums up his conclusion as follows:

1. The elongation of the root is preceded by an epithelial proliferation at the border of the follicle. This proliferation plays the rôle of a trephine which opens the tooth to view and which delays the formation of the dentine of the root.

2. The modelling of the alveolus may be divided into two periods, coronal and root, which are especially distinct in the region of the second premolar; that is, at the side of the body of the mandible.

(*a*) During the coronal period, the alveolus responds to the pressure of the tooth by a resorption of the entire inner surface of its walls.

(*b*) During the root period, the alveolus does not react in a uniform manner to the pressures exercised by the growth of the root. The absorption of the lateral walls ceases gradually and is localized on their margins.

3. The various classic theories are insufficient because they are all based on one or the other of these processes of one tooth or the other and offer evidence of one process at the expense of the other.

4. The dental eruption is the result of the sum total of the phenomena related to

the tooth (elongation of roots) and to the alveolus.

5. It is difficult to establish the cause and effect relation between these two. They are concomitant and are related to more general causes.

6. The junction of the alveolar fundus coincides with the changes of form and position of the mandibular canal.

7. Dental eruption is not a local phenomenon, but an episode in the general growth of the mandible.

From all of this evidence, it seems apparent that eruption is being generally thought of as that process whereby the hidden tooth breaks through the gum and comes into occlusion. This view is not surprising when we realize that practically all of the worth-while work that has been done until very recently was histologic in its approach, so that the findings were of necessity of a qualitative nature. In order to point out the fact that different approaches might modify these findings, it will be necessary for us to review briefly a few points about the growth and development of the face.

Starting with John Hunter, in the eighteenth century, and coming down to date, with investigators in the field of growth, we find a number of methods employed and enough findings common to all of these methods that we are able to realize fairly well the changes that accompany the growth of the face.

At birth, the face is said to be about one-eighth the bulk of the whole head; while, in the adult, it constitutes about one-half. The cranium increases about four times up to adulthood; whereas, the increase in size of the face is three times as great. Again, more than three fourths of the total increase in growth of the brain has taken place by the seventh year, and nearly the whole by fourteen years. During even this time, the face is growing at a higher rate than is the cranium, and it continues to grow up until the twentieth year. The greatest increase takes place in length, or the vertical dimension. Both quantitative and qualitative methods have been used in the study of these phenomena, and when we piece the findings together, the following picture evolves.

At birth, the face is said to be back under the forebrain, and in a very low state of development as compared with the cranium. The spheno-occipital junction is cartilaginous, as are also most of the other basal sutures of the cranium. The floor of the nose or hard palate is at a level that is only slightly below the floor of the orbit. The orbits are well developed in size and their floors literally constitute the base of the alveolar process. The maxillary sinus is a mere slit close to the lateral wall of the nasal cavity.

In this small area of bone lie packed the germs of all of the maxillary teeth except the second and third molars—five deciduous and six permanent teeth in each half—and I should like to emphasize at this point that these buds lie in close proximity to the floor of the orbit. The alveolar process at this stage is only an indication of a ridge, being very little higher than the palate. This, then, is the picture of the upper face at birth. By what processes does this baby structure become the adult face?

A number of investigators past and present have described what takes place and a few have delved into the question as to how it takes place. Of the latter, Brash has given us the most complete picture of the processes involved with his extensive work on madderized pigs. These animals are fed bran soaked in madder which contains the two organic dyes, alizirin and purpurin. Forming bone has an apparent affinity for these dyes and takes on a red stain during the feeding. The red areas may be studied

directly; but while this gives a good picture of bone deposition, it makes difficult the study of the other bone activity that invariably accompanies deposition; namely, absorption. For this reason, an indirect method is used, the animal being fed madder for a time and then given a madder-free diet, so that new bone shows white, and quiescent or absorbing areas show red.

Brash has shown very conclusively what John Hunter insisted on; namely, that practically all bone growth takes place by surface addition, and that form and lightness are maintained by an interplay between this and absorption. His findings, roughly stated, are as follows:

The growth of the alveolar process probably contributes more to the height of the face than does growth of any other part. Bone is literally piled on its lateral surface, its rate of growth exceeding that of any other part. Bone is also deposited on the under surface of the hard palate in much the same manner, but at a slightly slower rate. In this manner, the alveolar process gradually assumes a lower level and becomes a ridge at the border of the palate. The thinness of the hard palate is maintained by an accompanying absorption of the floor of the nose and, in this manner, the palate is caused to descend.

The orbit acts in much the same way. Its floor is slowly resorbed as the alveolar process grows downward, but it attains adult size at an early age. By the fifth year, it is practically full grown, and its vertical height remains fairly constant, although its vertical axis changes slightly with the modeling of the face. From all of these activities, we see how the floor of the nose, which started at a level very near that of the orbit, comes to occupy a much lower level in the adult.

To return to the alveolar process: It will be remembered that more bone was deposited here than at any other site, and were this to be the only activity, we would soon have a terrific ridge of heavy bone projecting downward and outward from underneath the orbits. Here again, absorption maintains the balance. The maxillary sinus growing laterad comes to lie between the floor of the orbit and the germs of the teeth, and, as growth goes on, this cavity continues to expand until it hollows out the entire maxilla, its floor penetrating to a level lower than that of the nose. So much for the vertical dimension.

When we study the mechanism whereby the face is increased in width, we find the same two processes, absorption and deposition, at work. New bone is laid down on the outside of the maxilla, while the lateral wall of the sinus and the medial wall of the alveolar process is being absorbed, so that the face grows in width without materially increasing its weight of bone. The zygoma keeps pace by additions on its outer and absorptions of its inner surfaces, and this buttress is probably rebuilt four or five times during growth.

There are probably two sources for increase of the third dimension or depth of the face. One of these is addition on the labial surface and free margin of the alveolar process, which causes an increase in the arch width. The other is found at the site of the tuberosity.

Hunter was, I believe, the first to point out the importance of this site of growth, and it has been verified since. Bone is laid on the posterior and lateral surfaces of the tuberosity in an amount at least equal to the combined widths of the three permanent molars. A moment's thought reveals that this amount of posterior growth would shut off the pharynx if some adjustment did not take care of it. Just what the nature of this adjustment is, we are not prepared to say, but there are two possibilities.

By actual measurement and by superposition, we know that the tuberosity, in spite of its backward growth, actually travels forward. It will be remembered that it is backed up or braced by the pterygoid process of the sphenoid bone through the medium of the pyramidal process of the palatine. The sphenoid throughout growth is being gradually pushed away from the occipital by the growth of the cartilage between these two bones, and this may account for the forward movement of the maxilla. The other possibility is that the growth of the floor of the anterior portion of the cranium, to which the face is hafted, carries the face with it, and the marked growth activity at the pterygomaxillary junction is necessary for the maintenance of contact between these two bones. Regardless of whether either of these two or some other explanation is the correct one, the fact remains that during the growth the face comes to assume a much more forward position in relation to the cranium and that the teeth and alveolar processes are the most prominent of these forward parts. When we come to consider the mandible, we realize at once that it must undergo concomitant changes to adjust itself to the growing upper face. Starting out with only a suggestion of an angle, with a depth only half of what it will become and with a length that must be materially increased, it is evident that it must undergo very extensive alterations to attain its adult form and position.

In this bone, there are three main sites of growth. 1. Height is gained by additions to the alveolar process on its labial and buccal surfaces and on its free border. This process is a duplicate of that in the maxilla. 2. Width is gained by a deposition of bone over the entire outer surface, with a balancing absorption over the entire lingual wall. 3. Length is provided by heavy depositions on the posterior edge of the ramus accompanied by equal or slightly lesser degrees of absorption on the anterior edge and coronoid process. If we pause for just a moment, we realize that these three would contribute to the building of a larger bone, but that they would not in themselves provide for adjustment with the maxilla. As we have seen, the latter bone is gradually assuming a lower and lower relation to the floor of the cranium, so that the dental arch is carried downward and forward. Now, if the mandible were not adjusted to this, the growth of its own alveolar process plus the increase in vertical height of the upper teeth would soon lead to a condition where the most posterior teeth would constitute a block between the jaws, and thus the bite would be opened. The area of adjustment for this in the mandible apparently lies mainly in the condyloid process, upon whose articular surface bone is laid down; which contributes to the length of the ramus.

This is necessarily a very sketchy outline of the manner of growth of the jaws and face, but time will not permit of greater detail. There is one point that must be taken up, since it affects the material under consideration. This point is the transformation of the newly deposited bone of the alveolar processes.

There is absolutely no evidence of the growth of bones by the so-called method of interstitial growth, as was advanced by Belchier and several investigators since his time. This does not mean that no interstitial changes take place. Compact bone may be changed to cancellous, or vice versa, and these processes are going on all of the time. According to Brash, the bone laid down on the surface becomes first cancellous and subsequently compact, this depending on its level; and he further insists that there is no evidence

to support the theory that alveolar bone is in any way different from the bone that underlies it. In support of this contention, he submits measurements taken from the alveolar and lower borders of mandibles. These measurements show very definitely that from 70 to 100 per cent of all growth in the vertical dimension is contributed by the alveolar border; while the lower border contributes from 0 to 30 per cent. Thus, on the average, the alveolar border grows at least seven times faster. During the time covered by these measurements, the relation between basal bone and alveolar bone is shifting in such a way that one cannot escape the conclusion that a constant transformation of alveolar bone into basal bone is taking place and that the dental canals, etc., instead of being fixed landmarks are actually sinking into the base bone. The main point that I wish to bring out in this connection is that the bone which surrounds the buried teeth is in a terrific state of activity throughout the period of growth and that it is entirely likely that this activity bears some relation to the eruption of the teeth.

The mandible has been the favorite bone to study in this connection, because, being an entity, it presented a less complex picture than did the upper jaw with its sinuses and sutures. For this reason, a point has been missed that seems to have great significance in the eyes of the author. If we think only in terms of the mandible, it is a relatively easy matter to consider eruption as being caused by any one or by all of the factors that have been enumerated, because, in the mandible, the increase in the vertical dimension from birth to adulthood is not much, if any, greater than the length of the roots of the permanent teeth. Also the direction of development and the direction of eruption are opposite. In addition to this, the occlusal plane is being constantly lowered; while the lower teeth are rising toward occlusion.

When we consider the maxilla, there are several self-apparent facts that cannot be denied. The first of these is that the teeth, taking their start from under the baby orbit, ultimately come to a position an inch and a half or more below that orbit, to say nothing of their movement in a lateral and forward direction. Secondly, it is self apparent that this migration is at a rate of speed greater than the growth of the bone, since these teeth, starting above the alveolar surface, meet it at the point which we usually designate as eruption, and then pass it. We thus have a movement of this tooth germ through or with the bone that amounts to a far greater distance than can be explained by the growth of the tooth or by cell multiplication or by pulsating blood vessels. None of these former theories explains this migration, and yet it seems only logical to include this phenomena under the heading of eruption.

Another phenomenon that has been ignored is that which pertains to the expansion or lateral growth of the jaws. If the alveolar processes are being moved laterally by deposition on the buccal and absorption on the lingual aspect, it follows that structures such as unerupted teeth contained within these processes would ultimately come to be exposed on the lingual aspect. Brash takes cognizance of this problem, but only after the teeth have erupted. His specimens show that the teeth continue to move with the bone even after they are in full eruption. The mechanism that takes care of the adjustment is the same that we have seen in other places; namely, a deposition on the walls of the alveoli in some places and a resorption in others.

### TOOTH BUD AND ITS CRYPT

As checked by clinical evidence, some

of our ideas of developmental changes in the teeth are incorrect. It has been stated that the tooth germ within the crypt expands and that the crypt adjusts itself to this expansion by internal absorption and the cutting apart of its walls until it can spring, and by absorption of the spicules that brace it from without. I quote Noyes:

> Each tooth germ is enclosed in a separate crypt, the wall of which is formed by a cribiform plate. The walls of the crypts are braced against each other and the cortical plates of the maxillae by spicules of cancellous bone surrounding medullary spaces. As the tooth develops within the crypt, pressure is exerted and the crypt wall is pushed backward through the cancellous bone.
>
> The permanent tooth developing in its crypt produces conditions of pressure, and osteoclasts appear in all the medullary spaces, around and above the crypt, and through the alveolar process, as well as on the crypt wall. They are more active in the medullary spaces, cutting away the spicules of bone, thinning and cutting apart the crypt wall, and allowing it to be bent and pushed back.
>
> In studying the absorption of bone around the crypt walls, it has been noticed that the osteoclasts appear first in the cancellous bone surrounding the crypts and outside of it. Absorptions here remove the spicules which brace the crypt wall, and cut through the wall in such a way as to allow it to be pushed back through the weakened substance. In the same way in the movement of the teeth, absorptions appear first in the spaces outside of the cribiform plates of the alveoli, until the remaining bone is weakened sufficiently to spring under pressure.

While I am perfectly willing to believe that the tooth germ may expand in surroundings of connective tissue and that this connective tissue may be condensed in some manner so that it resembles a fibrous sac, I would submit that the roentgenogram shows very decidedly that the crypt is the first thing calcified and that it apparently does not thereafter enlarge. Furthermore, when calcification of the tooth starts, there is no further increase in its intercuspal dimensions since measurements taken between the tips of the cusps of the crowns when their calcification first becomes noticeable roentgenographically are identical with measurements taken of the same points in the adult tooth.

Using large numbers of roentgenograms of growing children, Broadbent has shown the approximate ages at which crypt calcification begins, and since, in the case of all of the teeth except possibly the third molars, this takes place at a very early age, it follows that these tooth crypts with their enclosed germs must travel a considerable distance before they come to the place where the crypt ruptures and the tooth emerges.

Here, we are faced with a problem that is unique in the study of bone. If these crypts are trussed and braced against the cortical plates, as most authorities seem to think, there must be some alteration in this bracing that permits of this movement. If this activity is one of bone spicules, we would have to admit that interstitial bone growth was a possibility; for this would imply that all of these spicules at regular intervals would have to be capable of yielding, either by elongation or compression at the same instant, and this seems hardly reasonable. On the other hand, this cavity might be caused to migrate, as Brash suggests, by deposition at some sites with accompanying resorption at opposite sites.

Whatever it is, we must acknowledge that there is another mechanism than those already advanced to account for the movement of the tooth germ through the bone of the jaws. This mechanism may be a factor in the process that has come to be called eruption, and Brash

tentatively suggests that it might be wise to revise our thinking about eruption. The word sets certain definite limitations on us since it implies a breaking through. We now consider the development of the human individual from conception to adulthood, looking on birth as a mere incident of life that amounts to nothing more than a change in environment. So in the life of the tooth it would seem that the breaking through of the tooth is an arbitrary point along the line that has been given undue prominence. Probably a more significant point is the emergence of the tooth from its crypt, and this would give us two stages that would include the entire life cycle of the tooth; namely, its development within the crypt and its journey through the jaw up to the point where the crypt ruptures. The second stage would include those changes that follow the rupture of the crypt and the emergence of the tooth therefrom. Thus, all four of Gottlieb's stages of eruption would be thrown into the second stage.

I should not wish to be understood as criticizing the excellent work that has been done by the various investigators who have worked in this field, and the points herein enumerated are but suggestions which may have no value whatsoever. The investigator may be readily excused if he gains but one view of his problem, because the technical difficulties that he must overcome are so wasteful of his time that he is unable to go very far afield. On the other hand, the outsider sees less detail in any one field and is therefore less likely to be influenced by any particular point of view or mode of attack. If he takes only findings and disregards the conclusions of the investigators, he is able at times to see complete agreement between antagonistic points of view. At other times, he is able to see gaps in the chain of evidence the filling in of which might help to solve some of the problems.

## SUMMARY

1. Eruption has been thought of generally as that process whereby the invisible tooth breaks through the gum and comes into occlusion.

2. It has been acknowledged by all investigators to be a phenomenon of general growth, but review of the literature reveals that growth has been largely ignored in its study.

3. The most important contributors to our knowledge of eruption have been histologists and their approach has, of necessity, been almost entirely of a qualitative nature.

4. The theories advanced thus far have been that the process involves: (*a*) elongation of the root; (*b*) multiplication of the cells of the pulp; (*c*) addition of cementum to the root; (*d*) growth of alveolar bone; (*e*) combinations of all of these.

5. Growth studies of various kinds reveal that, at birth, the germs of all of the teeth, with the exception of the second and third molars, lie packed in the jaws; which, at this stage, are extremely small. In the maxilla, they are in close proximity with the floor of the orbit.

6. During growth, the face descends and goes forward and outward so that, by the time the adult stage is reached, the teeth have traveled through space a matter of approximately an inch and a quarter to an inch and a half. Growth of the bone has been shown to be a matter of surface deposition and resorption, but the mechanism whereby the tooth germs are able not only to travel with this bone, but actually to exceed it, remains unexplained.

7. The study of the mandible does not make these problems so apparent, since the occlusal plane is descending while the teeth are ascending.

8. Roentgenographic and other evi-

dence points to the fact that the crypt begins calcification before the tooth germ, and that once calcification begins in the tooth, its coronal dimensions do not change. It is tentatively suggested that it would be wiser to think of the migration of the crypt through the jaw as the first stage of eruption, and that the second stage be considered as having its inception when the tooth begins to leave the crypt.

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# DIAGNOSIS AND TREATMENT OF ADAMANTINOMA*

By CALE M. LOGSDON, D.D.S., Hines, Ill.

THE adamantinoma is a rare basal-cell bone neoplasm that occurs only in the maxilla and mandible, but is more commonly found in the mandible. It is a slow-growing, central-expansion bone tumor which will expand the bone corticle to a paper thinness, and will eventually break through the bone plate. It is malignant and it metastasizes. Recurrence is inevitable if it is incorrectly treated. Death is usually caused by sepsis, as the tumor becomes infected, breaks down and drains intermittently. It may occur any time from the eruption of the first permanent teeth to extreme old age, and a history may be obtained of its presence from a few months to many years.

As with other malignant growths, there are several theories as to the etiology of the adamantinoma. In all probability, it is the result of a neoplastic transformation of the tooth germ, as it occurs only in bones capable of producing teeth. Occasionally, recurrence of a lesion, such as a dentigerous, follicular or root cyst, that was at the time of removal thought to be benign, will, at the second operation, be found to be an adamantinoma. The first operation was incomplete, some of the adamantine tissue remaining. Dental lesions that are at all questionable should be tested for malignancy by biopsy, frozen section or section of the gross specimen under the microscope. This will often avoid embarrassment and will protect the patient. Recently, I removed a small growth from the gum region that looked harmless and was thought to be an ordinary benign epulis, but which proved to be a squamous-cell carcinoma by section of the mass under the microscope.

Fig. 1.—Mandible taken five years after development of adamantinoma.

The adamantinoma may be found to

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vary in size from that of a marble to the size of an infant's head, this depending on the rate of growth and the duration of time that the condition has been present. The extremely large ones are vary rare, as treatment is usually sought at the onset. The first symptom noticed by the patient is swelling. Extension may be externally or into the oral cavity or in both directions. Tenderness on pressure will be noted, but little if any pain. The extended area may present any degree from a soft crepitation to a bony hardness, as the tumor varies in consistency, this depending on the degree of expansion. The mucous membrane is usually intact and the skin over the area will not be adherent. Other central bone lesions may present identical symptoms. The final diagnosis of any tumor is made only with the microscope. The adamantinoma may expand slowly for several years and, for an unknown reason, begin to grow rapidly.

Fig. 2.—Case shown in Figure 1; eight months later.

The roentgenogram may show the adamantine area to be a single cyst, numerous small cysts or a solid mass, or any or all three conditions may exist in the same bone. I have a case in mind wherein the roentgenogram of the mandible showed a large cyst in the left first molar and bicuspid region, numerous small cysts in the anterior region and a solid mass in the left bicuspid and first molar area which was diagnosed as an adamantinoma. Among them might be the dentigerous cyst, large follicular or root cyst, giant-cell tumor, fibroma, etc.

The gross specimen of the adamantinoma may be cystic or solid or the same specimen may present both conditions. On cross-section of the solid specimen, numerous minute cysts will usually be present. The solid areas contain a friable cellular tissue ranging from brown (hemorrhagic) to a grayish white. The cystic specimens are filled with a thin straw-colored fluid.

Fig. 3.—Case as shown in Figure 2; eight months later.

The prognosis of the adamantinoma is favorable in the early and moderately advanced cases, and the treatment is surgical removal and thermal or chemical cauterization of the surrounding tissue to destroy any minute particles of adamantine tissue that might be retained. The type of surgery would be curettage in the cystic type. The solid and semisolid masses would have to be dissected out. In the past, cases were often far advanced before the patient sought treatment and, as a result, complete resection of the bone

was necessary to stop the growth. We see most of these cases in the early stage nowadays and mutilation or complete resection can be avoided by removing all of the involved tissue and cauterizing the surrounding area to destroy any pathologic tissue that might be left in the bone recesses. A small corticle of retained bone will regenerate sufficiently to function if it is free from disease. As in other malignancies, the cure of the adamantinoma is counted on at the first operation. Even though the lesion is radioresistant, preoperative irradiation (deep roentgen-ray therapy or radium) would protect the patient in case the lesion was found after removal to be some other type of malignant growth, and this would not do the adamantinoma any harm. As stated before, the diagnosis of any lesion is never made until a section is examined under the microscope. After an incomplete operation, the adamantinoma takes on a rapid rate of growth and expansion, and it is essential that all of the adamantine tissue is removed or destroyed at the first attempt at treatment.

Fig. 4.—Adamantinoma of mandible present for fifteen years.

Since about 80 per cent of adamantinomas occur in the mandible, I shall report one of the maxilla on which I operated.

Swelling of the right side of the face and right side of the palate had existed for the past two years and had gradually become more marked. There was some tenderness on pressure, but practically no pain. The patient was a white man, aged 36, in good physical condition. The red blood count was 3,500,000; white, 9,000; hemaglobin, 80 per cent. Examination revealed swelling of the right side of the face. The upper right second bicuspid and third molar teeth were missing. The labiobuccal mucosa was bulging from the upper right cuspid to the first molar, and the palatal mucosa of the right side was extended from cuspid to first molar. On digital pressure, the labiobuccal and palatal bulging region of the right side gave a soft crepitation. Dental roentgenograms showed a cystic area of the right side of the maxilla between cuspid and first molar, and a horizontal impacted tooth between the first bicuspid and the first molar. Lipiodol was introduced into the right maxillary sinus by the nasal route and an 8 by 10 roentgenogram was taken of the region to determine whether the cystic condition involved the sinus. The radiopaque substance did not drop below the floor of the sinus according to the roentgenogram.

Fig. 5.—Case shown in Figure 4.

Under block anesthesia, the upper right lateral incisor, cuspid, first bicuspid and first and second molars were removed. An anteroposterior labiobuccal incision was made from the cuspid to the second molar area. The soft tissue was dissected back,

the thin bone corticle being exposed. The thin bone that covered the cystic area was cut away by a ronguer, removal of the mass leaving the palatal corticle exposed. The cavity was thoroughly examined for any minute particles of adamantine tissue that might have been left, and the surrounding bony wall was tested for minute recesses. Luckily, the maxillary sinus was not involved, but a concavity was present under the floor of the sinus; which indicated that the growth had pushed the floor of the sinus up. The floor of the sinus was very thin, as was also the palatal corticle which was left. After being examined the cavity was cauterized with a solution of phenol 90 per cent, and camphor 10 per cent; then swabbed with alcohol. The soft tissue was trimmed and sutured. The cavity was dressed with an iodoform dressing, the large flap of soft tissue being allowed to collapse. The dressing was removed every seventy-two hours, and the cavity irrigated and redressed for twelve days thereafter, the dressing being discontinued and the cavity kept clean by irrigation until granulation ensued. After the wound healed, there was a considerable depression where the growth had been removed. The impacted tooth was removed with the mass, which was diagnosed as an adamantinoma by section under the microscope.

The three roentgenograms (Figs. 1-3) show an adamantinoma of the mandible. Figure 1 was taken five years after onset. An incomplete operation was attempted soon after the film was taken. Undoubtedly, all of the adamantine tissue was not removed, as Figure 2, which was taken eight months after Figure 1, shows that the lesion has taken on a rapid rate of growth. Figure 3, taken eight months after Figure 2, shows that the ramus and body are involved to the median line. Resection of the ramus and body of the mandible to the median line would be indicated in the condition shown in Figure 2 or Figure 3.

Figure 4 shows an adamantinoma of the mandible of fifteen years' duration. The mandible is involved from the first molar on the left side to the first molar on the opposite side. Figure 5 is of the same case as Figure 4, showing extension on the lingual side. The growth began linguad from the lower anterior teeth and was about the size of a small marble when first noticed by the patient, fifteen years ago according to the history. When this roentgenogram and this photograph were taken recently, the growth was hard and was extending lingually about 1.5 cm. from bicuspid region to bicuspid region on the opposite side.

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# DENTAL LITERATURE: WHY READ IT?

By A. T. RASMUSSEN, D.D.S., F.A.C.S., LaCrosse, Wis.

FROM time to time, some one presumes to criticize the dental journals severely for the kind of material published. Constructive criticism is desirable and tends to improve the thing criticized; destructive criticism never accomplishes good.

Some there are who criticize severely those journals that publish articles of a scientific nature; articles dealing with fundamental principles underlying the intelligent practice of dentistry. Our own JOURNAL OF THE AMERICAN DENTAL ASSOCIATION has come in for its share of

criticism for printing articles of a scientific nature.

Such criticism is, of course, based on a lack of knowledge and appreciation of the fact that in order to practice one's profession intelligently, the basic scientific principles and laws governing both health and disease must be understood, as seen in the light of present-day knowledge. Scientific findings, as they pertain to dentistry, must be published. The place for them is in the dental journals.

Some would criticize the journals because authors are not always in agreement as to cause and effect, or method of treatment. This class of individuals seem to expect finality; a rule of thumb, as it were, for everything. As long as we have thinkers, we shall have differences of opinion. This is inevitable, and not altogether undesirable, for it tends to stimulate the reader to individual thinking, unless, indeed, he is entirely a blind follower of some other person, or a near-robot.

Just now, another instance has come to our notice in which some one anonymously attempts to hurl a criticism at all dental journals and thereby indirectly at the editors, publishers and authors, most of whom at least are trying conscientiously to publish material that will be a credit to the profession that they serve.

In the June, 1934, number of THE JOURNAL, the Editor published an anonymous letter received by him, and made some very pointed editorial comments on it. Like the Editor, I feel that an anonymous letter is rarely worth the paper it is written on and ordinarily not worthy of a second thought. The letter referred to, however, is unique so that one is moved to comment on it even though the writer of the letter did not have the courage to sign his name.

To save the reader the trouble of looking it up, I quote the letter. "As I have said before, a dentist might read his head off in all the dental journals of all kinds, and he would be more mixed up and confused than if he stuck to the education he received in dental college, and his own experience."

Judging from the wording of the letter, we are inclined to believe that the writer, as far as he himself is concerned, was right, and we fear that he expresses the sentiment of too large a number of those who claim membership in the dental profession.

The Editor honors the letter quoted by saying that it constitutes an endorsement of the colleges while severely arraigning our dental journals. Possibly it might be so construed. It is my opinion that that kind of endorsement is one that our better colleges would not welcome.

While it is true that there are certain technical procedures that must be taught in dental schools, of equal or far greater importance is the teaching of the fundamental principles that underlie the practice of dentistry or any other branch of the healing art, bending every effort toward developing the student's mind so that he can keep abreast of the advancement of science, especially as it pertains to his own profession, and, if possible, to add something to our store of accumulated knowledge.

Any school or college professor who teaches any scientific subject as abstract, leaving no room for differences of opinion or additional knowledge, is a poor excuse for a college or a teacher, to put it mildly.

One of the prime principles of any institution of higher learning, be it a school of dentistry or whatnot, should be to develop in the student, to a degree at least, an ability to make proper evaluation of things or teachings, whether in the classroom or on the printed page.

To paraphrase a saying by Dean Bauer, of the Northwestern University

School of Engineering, it should be the purpose of a dental school to turn out university trained men and women who have specialized in dentistry, rather than to operate a glorified trade school.

Anyone with the ability to think clearly must realize that science in all its branches is advancing, and that we are gaining knowledge so rapidly that, college graduate though he may be, he who has not learned, to some degree at least, to analyze the sayings and teachings of other men and to make proper evaluation of individuals and their teachings, is sure to find himself tossed about on a sea of bewilderment. Only he who has learned to make such evaluations can expect to practice successfully the healing art, in any of its branches.

Of course, there are many things on the printed page, both in dental journals and other publications, which are not carefully thought out before being published. The same is true of many things taught in the classroom. This is not to be wondered at, human nature being what it is.

The person who desires to gain or maintain a place anywhere near the front rank of his chosen profession, whatever it may be, must learn to read and analyze with intelligence the things written by his colleagues. He must develop an ability to separate the wheat from the chaff. This he cannot be expected to do as well when he leaves college as later in life, provided he has continued to cultivate his ability along that line.

Again, it is true that just to read an article through may be an utter waste of time; whereas, a careful perusal and analysis may reveal much of value. The more meat there is in an article, the more carefully it must be read and studied. After all is said and done, the printed page plays an important rôle in the advancement of any of the sciences.

We have many professional journals, all of which contain something worth while. It frequently becomes a problem as to which ones can be eliminated from the subscription list; for no one can read all the material that is published; but usually when the list is made up, each year finds additional subscriptions rather than fewer. This must necessarily be so, as long as we expect to advance. As soon as we are willing to stand still or go backward, we can discontinue the publishing and reading of our journals and the retreat will come surely and quickly.

The literature of a profession is what makes it, for were it not for the total of recorded knowledge, we would be in a sorry plight indeed. None of us can agree with everything that appears in any of the journals. A man who expects to be able to practice his profession intelligently must learn to study the printed page. When he graduates from college, he is still very near the beginning of his education, and unless he continues his studies, thereby keeping abreast of his time, he must of necessity be a failure, notwithstanding he may accumulate a sizable fortune.

211-212 Linker Building.

# AN UNUSUAL CASE

By R. P. GINGRASS, M.D., D.D.S., Milwaukee, Wis.

A. K., a white man, aged 22, came in for the removal of a tooth.

At the age of 7, the patient developed an osteomyelitis of the left side of the body, angle and ramus of the mandible, following the removal of a deciduous molar. Four sequestrectomies were performed in the course of from two to three years after which the condition remained quiescent.

Fig. 1.—Side view of patient showing molar tooth, making its appearance through skin at angle of mandible. The tooth is firm in the jaw.

For the past three years, the patient has noticed what he thought to be a piece of bone protruding through the skin of the face at the angle of the mandible. It was not until a short time previously that he was told by a cultist whom he had consulted for treatment that he had a tooth there instead of a piece of bone. (Figs. 1-2.)

External examination revealed an asymmetry of the face, the mandible deviating to the left side. There was considerable depression of that side of the face especially in the region of the angle. A large amount of unsightly scar tissue was present in the submaxillary region. A well formed, discolored crown of a molar tooth (probably the second molar) was found to have erupted through the skin and was directed laterad. A small amount of purulent material present around the crown was caused by local irritation of the skin.

Fig. 2.—Close-up view, showing tab of skin overlying mesial part of crown. Extensive scarring can be seen below the tooth.

Intra-oral examination revealed that the median line had shifted to the left the width of one lower central incisor. No teeth were present on the lower left side distad from the first bicuspid. The remaining part of the examination was negative. (Figs. 3-4.)

Roentgen-ray examination revealed the presence of two molar teeth in the region of the angle, the lower one lying horizontally with the crown directed laterad; the upper, lying obliquely, crown downward, and apex upward in the ramus. There is considerable bone absorption around the crown of the upper molar. The posterior

border of the ramus presents a hook-shaped process of bone. The condyle is small and abnormal in shape. The glenoid fossa is shallow with a poorly developed eminentia. The coronoid process appears lengthened. The anteroposterior width of the ramus is about two-thirds its normal size. The angle and body are smaller than normal.

COMMENT

At the age of 7, the crown of the lower second molar was partially developed. The roots had not made their appearance. It is very probable that the osteomyelitis was responsible for the torsion of the tooth follicle with its consequent eruption on the face. It is also probable that trauma at the time of the sequestrectomies was responsible for torsion of the tooth follicle.

Fig. 3.—Lateral jaw roentgenogram of ramus, showing two molar teeth at angle, hook-shaped process of bone on posterior border of ramus, condyle, glenoid fossa and coronoid process.

The condyle appeared as though it might be a regenerated one.

The position of the third molar could probably be explained on the basis of the malposition of the second molar.

In the treatment of a case like this, one must seriously consider the danger of a pathologic fracture. Should one or both teeth be removed at the same operation?

Fig. 4.—Lateral jaw roentgenogram of angle, showing two molar teeth with considerable rarefaction around crown of upper molar.

Or should the one tooth be removed externally and, after a lapse of from six months to one year, the other tooth be removed intra-orally?

# The Journal of the American Dental Association

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# *Editorials*

## THE REACTION OF TWO GREAT ASSOCIATIONS

At the meeting of the American Medical Association, June, 1934, much attention was given to the relationship existing between the medical profession and the public, particularly as it concerns the economic welfare of both. In the house of delegates, a special committee reported as follows:

The delegates have in their hands a pamphlet entitled "Sickness Insurance Problems in the United States" as presented by the Board of Trustees.

Your committee does not recommend any plan, but has abstracted from the pamphlet the following principles and suggests that they be followed by all constituent bodies of the American Medical Association as bases for the conduct of any social experiments that may be contemplated by them:

First: All features of medical service in any method of medical practice should be under the control of the medical profession. No other body or individual is legally or educationally equipped to exercise such control.

Second: No third party must be permitted to come between the patient and his physician in any medical relation. All responsibility for the character of medical service must be borne by the profession.

Third: Patients must have absolute freedom to choose a duly qualified doctor of

medicine who will serve from among all those qualified to practice and who are willing to give service.

Fourth: The method of giving the service must retain a permanent confidential relation between the patient and a "family physician." This relation must be the fundamental and dominating feature of any system.

Fifth: All medical phases of all institutions involved in the medical service should be under professional control, it being understood that hospital service and medical service should be considered separately. These institutions are but expansions of the equipment of the physician. He is the only one whom the laws of all nations recognize as competent to use them in the delivery of service. The medical profession alone can determine the adequacy and character of such institutions. Their value depends on their operation according to medical standards.

Sixth: However the cost of medical service may be distributed, the immediate cost should be borne by the patient if able to pay at the time the service is rendered.

Seventh: Medical service must have no connection with any cash benefits.

Eighth: Any form of medical service should include within its scope all qualified physicians of the locality covered by its operation who wish to give service under the conditions established.

Ninth: Systems for the relief of low income classes should be limited strictly to those below the "comfort level" standard of incomes.

Tenth: There should be no restrictions on treatment or prescribing not formulated and enforced by the organized medical profession.

Naturally, we have little comment to make on the problems presented to the medical profession at this somewhat critical time, but we have confidence that the members of the American Medical Association, after due deliberation, may be depended on for a sane and logical consideration of this important question.

What does concern us most intimately is the action taken by the American Dental Association at the meeting in St. Paul, August, 1934. Following is the report of the special committee on dental economics as revised by the reference committee, and unanimously adopted by the House of Delegates of the A. D. A., Thursday afternoon, Aug. 9, 1934:

The Special Committee on Dental Economics believes there is a possibility that some form of legislation will be presented to the people of this country, dealing with what is called "Economic Security" which will provide old age pensions and benefits for unemployment and health.

Therefore, we wish to place before the American Dental Association before such legislation becomes an actuality, the following principles, believing them to safeguard the best interests of all concerned.

1. In all conferences that may lead to the formation of a plan relative to this subject, there must be participation by authorized dental representatives.
2. The plans should provide dental care for indigents and needy children.

3. The plans should give careful consideration to the needs of the people, the obligation to the taxpayer and the interests of the profession.

4. The plans should be flexible so as to be adaptable to local conditions.

5. There must be complete exclusion of proprietary or profit-making agencies.

6. All features of dental service in any method of dental practice shall be under the control of the dental profession, as no other body or individual is educationally equipped to exercise such control.

7. All legally licensed dentists of a locality should be eligible to serve under such regulations as may be adopted.

8. Persons eligible to such service should be free to choose their dentist from the list of those who have agreed to furnish service under the adopted regulations.

9. Freedom of practitioners to accept or reject patients and freedom of all persons, who so prefer, to obtain dental service other than that provided by such plans, must be assured.

10. An adequate program should be provided for public education on the need of and the opportunities for dental care.

We ask a careful consideration of the foregoing actions taken by these two national organizations. The amount of imbalance and the lack of logical reasoning that have resulted from the recent years of economic unrest must be reckoned with in any deliberation on the subject. A temporary emergency has been seized on as a basis for a permanent procedure, and the principles that have built medicine and dentistry have been flouted as of no consequence. The integrity of the profession has been seriously threatened, and the welfare of the people placed in jeopardy by will-o'-the-wisp reasoning and wild-eyed speculation. Ideas and theories have been advanced that will never stand the test of time or experience, and we are blandly admonished to traffic with state medicine and state dentistry as if they were a panacea for all of our ills. Pity the day when we listen to the siren song of state dentistry. The moment that the destinies of dentistry are placed at the disposition of the state, that moment will see the virtual disintegration and demoralization of the profession.

All of the stable principles on which dentistry was founded will go for naught the moment that the state is permitted to dictate the policies or direct in any way the activities of our professional practice. The state is no more fitted to govern the practice of dentistry than is the dental profession fitted to govern the commonwealth—not so much. It is conceivable that a body of dentists might be able to formulate laws that would safeguard the welfare of the people,

but not by the wildest stretch of the imagination could the average legislative body successfully cope with the problems of dental practice. It requires long years of specialized professional training to know what policies are best for the people when it comes to dispensing dental service, and the sorry spectacle presented by some of our legislatures in their attempts to administer specialized enterprises of this character should make us pause, and deliberate long and earnestly before lending any encouragement to schemes of this kind.

There may be some significance in the attitude of the present national administration in its effort to develop a "program for economic security." In the attempt to foster the idea of social insurance, a committee was developed known as the Committee on Economic Security, and it is expected that in the near future an advisory commission will be appointed "composed of representative citizens from all parts of the country."

*The Journal of the American Medical Association,* in its issue of Aug. 25, 1934, presents a very pertinent editorial raising the question as to whether representation shall be given on this commission to members of the medical profession. As a matter of strict equity and justice, as well as the question of human welfare, recognition should be given in any social problem of this kind to trained professional men and women, and the judgment of the professional groups should be made available for the ultimate good of the people. We can no longer afford to trust wholly to the acumen of the lay mind in the solution of problems so intimately associated with public health and well-being.

State dentistry is wrong in principle and would be disastrous in practice. Through such a medium, dentistry never would advance, nor would the people ever be properly served. Individual initiative —the stimulant of professional progress—would wither at its source, and the incentive to scientific study would be forever gone. Government domination of the individual has been carried too far already. It is the incubus on our citizens that today threatens not only the welfare of the people, but also the very stability of society at large. Under the false pretense of lending succor to the needy, government has usurped a prerogative that does not legitimately belong to it.

The whole question of dental relief requires careful consideration, but at this time it is sufficient to say that the problem cannot be met through the medium of state dentistry. In another issue, we hope to discuss in more pointed fashion and in greater detail the wide question involved in the care of the poor and needy, a question that has elicited considerable comment in recent times, much of which, may we say, is so wide of the mark that it is far from furnishing a suitable solution. Mayhap it is difficult to effect a solution, but at least we should approach the situation with clarity of vision as suggested by the experience of the past.

## "ACCEPTED DENTAL REMEDIES"

The publication of the book "Accepted Dental Remedies" has been looked forward to with the greatest interest. It is the culmination of an effort on the part of the Council on Dental Therapeutics that has been in contemplation for some time. It has been compiled with the evident intent to furnish a ready reference book on dental remedies for the student and practitioner. It represents the work of an earnest body of men who have given much time and effort to its preparation in connection with the work of the Council and it forms a concrete contribution to the literature of the profession.

It lists and describes those pharmaceutics that are of interest to the dental profession, and are acceptable to the Council. It may therefore be called a guide for the practitioner in his daily work, a safe guide hedged about with information of a reliable character, and not influenced by the propaganda of commercialism.

Out of thirty-seven dental schools, thirty have already promised to recommend the book to their students. The sooner rationalism is established in teaching and practicing dentistry, the better it will be for the profession and the public, and it should be the function of our Association to contribute to this end in every way in our power. The recommendation of remedies of known action and standardized usage is of the utmost importance in the service of the people, and while there is a pronounced tendency in both medicine and dentistry to limit the use of drugs to the legitimate necessites of the

case, it is all the more essential that where called for, remedies shall be used with rationalism and with the greatest care.

One of the most pronounced evils of the past has been the immoderate drugging of the people on the part of some practitioners, and we may even go so far as to say that the harm thus brought about comes very nearly being a counterbalance to the undoubted good that has resulted from the judicious use of drugs. This is particularly true when the recommendation of the practitioner and the propaganda of the manufacturer lead, as they sometimes do, to self-medication on the part of the patient. This practice has already in certain instances mounted to alarming proportions, and the harm that has resulted cannot be computed. The pernicious propaganda of the patent medicine vendor has many ills laid at its door, but none more potent or far-reaching than this tendency to self-medication.

Today, most intelligent people look with suspicion on the use of patent medicines, and now we must go one step farther and discourage the prevalent tendency for people to administer drugs indiscriminately themselves. If it is true that "a little learning is a dangerous thing," it is doubly true in its application to this matter of the use of drugs, and the potential harm that may result from the ignorant use of as powerful agents as are indiscriminately displayed at every corner drug store is something for the professional man to consider.

The publication of "Accepted Dental Remedies" is only one more step, as has already been indicated, to encourage rationalism in the practice of dentistry, and we trust that our members in particular and the profession in general may profit by its appearance at this time.

Its format is most attractive, and very convenient for quick reference, and above all the price has been kept down sufficiently to bring it within the reach of every member of the profession.

At one dollar per copy, it is felt that this book furnishes more for the money than most of the publications that have been offered to the profession. It may be obtained by addressing the Council on Dental Therapeutics, American Dental Association, 212 E. Superior St., Chicago, Ill., and enclosing $1.00.

## ANSWER YES OR NO

The frequency of the command "Answer yes or no!" makes this discussion pointed. The words seem to give the speaker a feeling of superiority, of deep satisfaction. "I don't want argument," he says. "I could not remember it. Answer, yes or no."

The person questioned is put in an annoying position. He can't just sweep the order aside as below the par of his mental processes. That would make him haughty, conceited, unfit for his job—a lot of such things. He might be branded as not knowing, and hiding ignorance behind a mere attitude. He would be proclaimed a stuffed shirt, ballooning with pretense. If he answers as requested on the chance that he will not be quoted or named just to satisfy and be rid of his questioner, he has compounded his worries: He can't be sure his questioner will be so thoughtful and—worse yet—with the reply goes his own self-respect. In such cases, generally, the man questioned does not give the prescribed "Yes" or "No." He more often attempts the impossible; tries to make his questioner see and understand the pros and cons of the case and, as often, fails.

The questioner puts himself in a position far from desirable if he could only see it. In the first place, he puts a grade below passing on his own intelligence. He is a student of the compend, pony-riding variety which connotes that he is no student at all. He shows that he knows little of life, of science, of philosophy. These subjects have no multiplicand and divisor. They know no simple addition or subtraction. He puts himself among the medievalists, the dogmatists, who would give a yes or no to questions that only pride and arrogance would assume. If in the future such a man asserts a positive affirmative or a positive negative, some one might question him and leave him in tatters. To say, "Dr. Wiseman is my authority" would not save him. The man with the "Yes or no" complex walks into trouble.

Every professional man has had the experience. He is asked daily for a direct answer where such an answer cannot be given. Is this or that curable? What causes this or that? Do you believe this or that? The usual intellect seems to want its information in pellets and capsules not too large. Skill in making replies may build a

reputation for knowledge. To say "I don't know" may diminish prestige. The "yes and no" answer is hard for the makers to clarify and for the hearers to follow, and very unsatisfactory, but every teacher knows how often this ambidextrous response has to be made.

In the dental domain, "Is this curable?" is the common query. It would be pleasant to say, "Certainly! It can be done by rule of thumb—my thumb." But usually the most modest affirmative is avoided. Too many "ifs" intervene. Modifying possibilities, annoying accidents, inexplicable miscarriage of plans and processes troop through the mind. Body chemistries that are vague, systemic possibilities of aid or hindrance, nervous response, heart strength or weakness, varying metabolism, metastases, a veritable army of elements enter the situation and he hesitates to say "yes." He hesitates also to say "no." He tries to omit "yes and no." He swerves from directness and strives rather to stimulate hope and confidence for cooperation. Chemistry has so many side chains; metabolism, many fluctuations; the human system is so dependent on chromosomes, hormones, vitamins, states of mind—what else can he do?

Another "What is cure?" To the patient, it means direct relief. To the doctor, it means a struggle. To the patient, the ill is a local thing. To the doctor, it extends beyond what the eye can see or fingers reach. Cure means eradication of cause to a sufferer. But eradication as the doctor sees it may be impossible by any art. If the growth or the disease is taken in time, the answer may be "yes." But who can say when the time limit is past? What has been the effect of its duration on the heart, the nerves, any vital organ? A diseased area may be eradicated and the patient go to the coroner. Is that a cure? After a fashion, it is, but it is not the cure patients seek.

What the doctor does is this: He acquires every scrap of knowledge available. He sorts, assays, evaluates. He grounds himself in the biologic phenomena. He watches responses to his treatments and lends himself to change. He forces himself to think in the known terms of life, but watches for the evidences of the unknown. The more he knows of the known, the better he can cope with the unknown when it appears. And by the same token, he will reply "Yes" or "No" less often and will say "Yes and no," with a growing tendency to say neither. T.

# *Obituaries*

## FRANK H. DEAN, D.M.D.

**(1885-1934)**

Frank H. Dean, recently elected Trustee of the American Dental Association, died September 10, after a three weeks' illness.

Dr. Dean was born September 12, 1885, his death occurring just two days before his forty-ninth birthday. In his youth, he was actively interested in athletics, playing football and coaching five championship crews of the Lakeside Boat Club in his home city, Worcester, Mass. He graduated from Tufts Dental School in 1910, and did postgraduate work at Columbia University, Northwestern University, Deaner Institute and the Mayo Clinic. He was a member of Delta Sigma Delta, the Elks and the Masons.

Dr. Dean specialized in roentgenology and was widely known as a diagnostician. He was very active in organizational and educational work and often served as director of clinics. Last year, he was president of the Massachusetts Dental Society. He was a member of the American College of Dentists, the American Academy of Dental Science, the New England Dental Society, the American Academy of Periodontology and the Society of Dental Radiographers.

The widow and one daughter, Shirley, survive.

## WALLACE HUMPHREY SPINKS, D.D.S.

**(1867-1934)**

Wallace Humphrey Spinks was born near Meridian, Miss., Oct. 2, 1867; died, August 6, 1934.

Dr. Spinks studied dentistry under his brother, the late M. E. Spinks, in Los Angeles, before matriculating in the Dental Department of the Atlanta College of Physicians and Surgeons, where he graduated in 1892. He was associated with his brother in practice in Los Angeles until 1897, when he opened his own office. Dr. Spinks was a very active participant in dental society affairs. In 1907, he was elected president of the Southern California State Dental Association, and he acted as trustee of the College of Dentistry, University of Southern California in the early years of its history. He was an expert golfer and was largely responsible for organization of the golf clubs of his state society and of the American Dental Association.

Dr. Spinks is survived by his wife.

## PRACTICE IN PARAGRAPHS

*This department is intended for busy readers. It aims to tell a vivid story in a few words. Items should be of a practical character, and free from padding—not more than a paragraph or two. We exact no limit, but two hundred words can tell most of these stories. Send in your ideas; they will be welcome.*

**Stabilizing Teeth Loosened From Trauma**—If teeth are loosened from trauma, they may frequently be supported and made firm till attachment takes place by the use of a ligature. In quick emergency work, the teeth may be ligated with waxed floss silk, and the teeth stabilized immediately. For a more permanent support, orthodontic ligature wire may be used and the teeth held firm indefinitely. If the wire stretches, so that the teeth threaten to loosen, it may be instantly tightened by crimping the wire.—*Editor.*

**Repairing Rubber Tubing**—A weakened rubber tubing of a Bunsen burner or blow torch may be easily repaired by the use of an anesthetic cartridge, by cutting the tube at the weakened place, removing the rubber plunger and end piece from the cartridge, and slipping each end of the tubing half way on to the cartridge.—*F. D. Voigt, Salem, Ore.*

**Removal of Brooken Root Tip**—In the extraction of upper molars, sometimes the tip of the lingual root breaks off and remains high in its position in the alveolus. It is practically in the floor of the antrum and even slight force with an elevator is likely to push it into the antrum. The following method of removal usually works well: With a medium-sized round bur in the handpiece of the dental engine, a hole is drilled a short distance alongside the fragment. Then, with a small, very sharp wheel bur, the hole already made is entered, the bur being pressed against the fragment. The engine is started a little and the operator then jerks down on the handpiece.—*N. P. Shearer, Kenosha, Wis.*

**Synthetic Porcelain**—Synthetic porcelain has many good as well as some weak qualities. To bring out the best qualities in this material, experience has shown that aside from mixing to the right consistency on a properly cooled and dried slab, one should stop spatulating when the mass begins to curl, pack in a dry cavity, hold the strip in place for about three minutes, coat the filling with cocoa butter, and let stand for at least ten minutes before varnishing. If possible, polishing should be deferred for at least a day or longer.—*Ryland O. Sadler, Baltimore, Md.*

**Care of Dental Handpieces**—To get the best wear and service out of dental handpieces, they should be well cleaned and oiled once a day. A handpiece should never be used when the bearings have become worn and it ceases to run true and steady. It is poor economy, besides being a menace to the pulp of the tooth on which one is operating.—*Ryland O. Sadler, Baltimore, Md.*

**Holders for Film Packets**—Wood holders for film packets are especially useful in the lower molar regions, but there are precautions to be observed for the best results. If the film packet does not fit tightly in the slot, it should be wedged with folded paper to prevent displacement. A drop of water on the edge of the packet aids in the wedging process. The film packet should be placed in the slot so that the cusps of the teeth will be registered parallel with and about 3 mm. from the upper edge of the films. This feature should be considered before the packet and holder are placed in the mouth, but subsequent adjustments may be necessary. The holder should be firmly seated on the lower teeth with the film packet drawn against the lingual surfaces before the patient is instructed to occlude on the holder. Tipping of the holder by the occlusion will be reduced by filing the upper surface to incline about 10 degrees mesially and distally from the center.—*Clarence O. Simpson, St. Louis, Mo.*

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**Why Amalgams Discolor the Hand**—Many times, the mixing of an alloy and mercury in the palm of the hand causes discoloration of the skin, discoloration being greater in certain persons than others and greater at times in the same person. This discoloration has been referred to as showing impurities in either the alloy or mercury, when in fact the purest of metal will discolor the hand badly under certain conditions. The discoloration is almost entirely due to the presence of oleic acid on the skin, which, in turn, is due to the presence of the crystallized human oil of the skin or the fats of the soap used in washing the hands. Jewelry of all descriptions and of any kind of metal pure or alloyed discolors the skin for the same reason. Pure gold (24-k fine) will reposit a green black stain. A simple test will prove this. The best example of oleic acid is found in the ear wax. Secure this from the ear on a clean pellet of cotton and rub it on a sheet of clean 24-k gold. The pellet will become markedly discolored. This is also true of all metals entering into the alloy of the various amalgams, pure or impure, and without distinction as to formula or method of combination.—*W. Clyde Davis, Lincoln, Nebr.*

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**Prognosis**—Prognosis in cases of malocclusion depends more on the operator's ability to estimate the patient's physical capacity for growth and development than on the mechanical phases of the treatment. That is why studies of the models alone are not sufficient.—*Frank A. Delabarre, Boston, Mass.*

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**Difficult Diagnosis**—The diagnosis of malocclusion at an early age is difficult and is based upon a knowledge of the constantly changing stages of growth and development. On the other hand, treatment at this period is simple and carries the added advantage of a large preventive value. The reverse is true of cases that have reached adolescence. Prevention is impossible. Its presence is self-evident even to the lay person. Treatment is rendered most difficult by the added complications introduced through malfunction.—*Frank A. Delabarre, Boston, Mass.*

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**Regular Visits to Dentist**—The patient who at regular intervals is encouraged to return to the dentist to have artificial dentures cleaned and repolished is giving the supporting structures the same insurance that the periodical "checkup" provides for the patient with natural teeth.—*E. C. Pendleton, Chicago, Ill.*

# COUNCIL ON DENTAL THERAPEUTICS

## MERCITAN PRODUCTS—NOT ACCEPTABLE FOR A.D.R.

The report which follows was sent to the L. D. Caulk Company. In reply, the firm invited the Council to send a representative to Milford, Del., to inspect the voluminous reports from dentists on the products, and stated that they planned to have the bacterial action of Mercitan cream and Mercitan fluid checked by outside investigators.

The recommendation of the referee that there was nothing in the firm's reply to cause a revision of the report, or the postponing of further consideration, since the Council cannot undertake to visit offices or factories of those whose products it is considering, its interest being in the finished products and the statements made for them, was adopted. A further postponement of consideration of these products would not be in the interests of the dental profession because advertising is available to the Council in which a number of reports from dentists were used, and the claims for Mercitan on which the Council commented were the basis on which the product was sold to dentists.

SAMUEL M. GORDON, *Secretary.*

"Mercitan" is the designation of a treatment, and of certain drug products used in connection therein, for pyorrhea, trench mouth and oral infections, which has been promoted by the L. D. Caulk Company, of Milford, Del., since 1921. The product as it is sold now comes in a neatly prepared operating unit. The latest advertising available apparently places more stress on operative procedure than on the drugs, but it would appear, from a careful reading of the advertising, that without the drugs included in the Mercitan treatment, success in the treatment of pyorrhea and trench mouth is not to be achieved. In other words, no statement appears in the advertising that treatment would be successful if no drugs, or drugs other than the Mercitan preparations, were used with the prescribed technic.

In order to have a proper understanding of the present day claims of the "Mercitan Treatment" and the product, it is desirable to outline briefly the historical background of the preparation. According to advertising issued about 1921, when the product was first introduced, Mercitan was conceived by a Dr. George S. Staples, of Texas. After some persuasion on the part of Dr. Staples, the Caulk Company reluctantly became interested in "the taboo subject of pyorrhea cure." As part of the demonstration of his method, Dr. Staples treated twelve cases with such a "degree of speed and efficiency that startled the skeptical and critical group that watched his work." Case after case "from simple inflammation of the gum margin to the dreaded trench mouth and chronic suppurative periclasia where deep pus pockets undermined the alveolar sockets" were "treated with extraordinary speed and surety." After more than a year of investigation, the results of all the tests made by the Caulk Laboratories "showed conclusively that a startling and convincing advance had been made in the treatment of gum diseases" and the treatment was offered for sale.

The method of sale, the story goes, was a departure from the usual sales methods. The new method was intended to keep the Caulk Company in touch with the dentists. The dental supply depots, except for billing the dentist for the materials, could not figure in the transaction. Another unusual feature of the promotion of the Mercitan treatment was the frankness with which the company treated the secrecy of the formula. To quote their statement:

Dentists would never accept any preparation of unknown formula, so the opinion ran. The practitioner wants to know what drugs he employs, so that he can judge their value and suitability for his use. Yet such knowledge of the formula would probably lead many dentists to predict the effect or non-effect of the treatment, without actual trial of it. Any such prejudice either for or against the treatment might therefore become a serious obstacle to success and correct observation in its use, because the effects of treatment in several important particulars come as a total surprise even to men of wide experience in therapeutics. Therefore all reference to formula was suspended indefinitely.

This policy was later changed, so that now a qualitative statement of composition appears in the advertising. When, in January of 1921, the president of the L. D. Caulk Company advised dentists by mail "that a new and important investigation of a new method for pyorrhea treatment had just been completed," orders came by telephone and telegraph and some dentists even traveled to Milford to carry home their sets. Eight months later, the firm was still receiving requests for the booklet. New orders came without solicitation and reorders were frequent. The firm proceeds to ask and answer the following question: "What explanation can account for such phenomenal success with a new pyorrhea treatment in spite of the apparently overwhelming prejudice that existed and the extremely conservative methods through which it was offered?"

The Mercitan plan, dentists were told, was not based on the idea that the germ that was the cause of the disease was known, but "No matter what germ does the damage, Mercitan will kill it quicker than any other known germicide." As the story is followed, a possible explanation is found as to why some "cures" might have attended use of the Mercitan method, for emphasis is properly placed on operative procedure. It is, of course, difficult to understand what is meant by "no matter what germ does the damage Mercitan will kill it quicker," unless it is known that these germs that Mercitan will "kill quicker" are actual factors in the etiology or progress of the disease, and this rather sweeping claim is not supported even by the firm's own limited data.

This was in 1921 and 1922. Since then, approximately ten years have passed, during which time Mercitan has been on the market. Surely, ten years is time enough to determine the place of a treatment or a medicinal preparation in the handling of disease. There is not available a statement of composition of the product as it was first put out, and this should be borne in mind. It may be assumed that the composition of the product has not been changed and the following statements are based upon this assumption.

Since that time, certain advances have been made: the package for the Mercitan operating unit has been made a little more elegant, the advertising is a little more restrained; but Mercitan continues to be advertised as a curative for certain gum disorders. It is claimed that the introduction of Mercitan was a definite contribution to modern dentistry in the field of pyorrhea and the usefulness of the treatment has been widened by the development of a system that has demonstrated its unquestioned value. Mercitan fluid and Mercitan cream are now claimed to have "an important place in the treatment as chemotherapeutic agents." And it is stated that "they destroy infection and build up tissue resistance."

The products in the Mercitan treatment consist of Mercitan fluid and Mercitan cream. A qualitative statement of composition is furnished in current advertising; a reversal of the company's earlier position.

Current advertising for Mercitan fluid states that it: (1) chemically removes necrotic tissue; (2) stimulates normal cell tissue; (3) is germicidal; (4) is astringent and contracts tissue.

Mercitan cream is stated to have nine functions: (1) as a germicide-disinfectant, killing germs and sterilizes, (2) as a parasiticide, kills animal and vegetable parasites; (3) as an antizymotic, inhibits fermentative processes; (4) as a styptic, arrests hemorrhage; (5) as an astringent, diminishes secretion and transudation; (6) as a sorbefacient,

promotes absorption; (7) as a deodorant, eliminates pyorrhea breath; (8) as an analgesic, relieves pain. It is further stated that it is nontoxic to cell tissue. (This claim is at variance with advertisements in English magazines. Because Mercitan cream contains 0.2 per cent of mercuric iodide, it comes under the schedule of poisons of the United Kingdom Pharmacy Act, and notice to that effect must be made.)

A qualitative statement of composition does not appear on the label. The name does not indicate the essential composition. A broad name to cover products of diverse chemical composition is not in the interests of rational therapy.

In 1928, because of the inquiries concerning this product which were received by the A.D.A. Bureau of Chemistry shortly after its inception, a request was made of the L. D. Caulk Company for a statement of the qualitative and quantitative composition of these products. After a lengthy correspondence in which the company raised a number of questions concerning the protection of its trade secrets, it furnished to the A.D.A. Bureau of Chemistry the following statements of composition of Mercitan fluid and Mercitan cream:

MERCITAN FLUID

| | | Mild Per cent | Strong Per cent |
|---|---|---|---|
| Trichloracetic acid $CCl_3$, COOH | = | 20 | 30 |
| Chlorbutanol $CCl_3$, C(OH), $CH_3$, $CH_3$ | = | 2 | 3 |
| Distilled water $H_2O$ | = | 88 (sic) | 67 |

MERCITAN CREAM

| | | Mild Per cent | Strong Per cent |
|---|---|---|---|
| Mercury zinc iodide $HgZnI_4$ | — | 1.0 | 1.6 |
| Mercuric iodide $HgI_2$ | — | 0.2 | 0.3 |
| Iodine monochloride ICl | — | 0.3 | 0.5 |
| Mercurous chloride HgCl | — | 6.5 | 10.4 |
| Tannic acid $C_{14}H_{10}O_9$ | — | 2.3 | 3.8 |
| Acetanilid $C_6$ $H_5NH$ $CH_3$ CO | — | 7.0 | 11.2 |
| Boric acid $H_3BO_3$ | — | 39.2 | 31.4 |
| Glycerylborate $C_3H_5BO_3$ | — | 43.5 | 40.8 |

The present advertising gives directions for instrumentation, such as scaling, planing and filing, much of which in essentially similar form can be found in textbooks on periodontal diseases. It suggests that case histories be taken; advice which, in its place, is useful, but which is not cognate to the medicinal value of the product. Both the liquid and the cream are advertised to be used in conjunction with operative procedures for pyorrhea, trench mouth, canker sores and other accompaniments of periodontal diseases.

The Council believes that the time has come to question the advisability of drug or supply houses continuing activities that are now being carried on by and are part of the function of a university. The concern of the Council in raising this question at this point may equally well apply to a number of other products, but the inclusion of commonly accepted knowledge in the selling of a product tends to give the none-too-careful reader the impression that the drug product advertised in connection with such advice is the curative agent. It is, of course, not pertinent to discuss what may be in the minds of the writers of such advertising, whether it be an idea of service to the profession or one of giving its own product a glory by reflected light or other manifestations that may arise, but it is clearly evident that the use of such information in connection with a drug product which cannot stand on its own feet is not in the interest of the profession, and unfortunately it is not in the interest of a promoter of a drug to give unbiased advice concerning other drugs.

Many drugs have been used in the treatment of periodontal disease. At one time or

another, many drugs or combinations of drugs have been recommended by a practitioner ethically or by a promoter for the treatment and cure of gingival disease. When the first moment of enthusiasm passes off and the results are viewed in a calmer and more critical light, one always finds that if there was a favorable prognosis, in most cases it was based on operative procedure (i.e., clearing away calculus, obliterating pockets, etc.), and the part played by the drug where actual harm was not done was of minor import. Thus, today, the practitioner has available nonproprietary prescriptions for several drugs which have been found useful in the treatment of gingival disease when accompanied by proper instrumentation. These are: sodium perborate, caustics (such as trichloracetic acid, chromic acid), arsphenamine in glycerine, topically applied, potassium permanganate, Fowler's solution, Bowman's solution, etc., and various dyes and combinations of dyes. However, it cannot be emphasized too strongly that in the present state of knowledge, drugs play a limited part in the treatment of periodontoclasia.

Mercitan fluids, as is noted by the statement of composition supplied by the firm, are nothing more than 20 per cent and 30 per cent aqueous solutions of trichloracetic acid to which small amounts of chlorbutanol have been added, possibly to overcome the pain produced by the astringency of the trichloracetic acid. The latter is one of the oldest remedies that have been used for caustic and astringent action on the diseased gums, but it appears to have been replaced by chromic acid when a caustic is desired, or by a mild oxidizing agent such as potassium permanganate or sodium perborate, or by the arsphenamines in glycerine solutions. Today, the use of trichloracetic acid is limited almost entirely in the dental office to local application for "canker sores" or cases wherein a mild astringent is required. Twenty to thirty per cent of trichloracetic acid with a little chlorbutanol possesses an astringent effect and, if not used to such an extent that sloughing of soft tissue is produced, will do no great damage. It is at once apparent that there cannot be any great difference between 20 per cent trichloracetic acid and 30 per cent trichloracetic acid applied locally, and the rationality for marketing two strengths of trichloracetic acid under one name is not apparent, even though "mild" or "strong" is part of the designation. It is difficult to see how a solution of trichloracetic acid when brought in contact with the gums will stimulate normal cell tissue. This claim is preposterous and incidentally is a too common claim made in connection with the promotion of pyorrhea remedies. This is further discussed under the bacteriologic actions of Mercitan fluid.

Trichloracetic acid is a protein precipitant. How a protein precipitant stimulates normal cell tissue is not readily apparent. At least, a large number of carefully controlled tests and clinical cases should be made available to support the statement and a clearer definition of what is meant by "stimulates the cell tissue" should be made.

Thirty per cent trichloracetic acid is antiseptic and germicidal by virtue of its protein destructive effects. Like other mineral acids, it is caustic. Trichloracetic acid forms relatively firmer eschars, which, in a sense, circumscribes the action of the drug and makes it less painful, and thus it is preferred to sulphuric, nitric or other mineral acids. If a dentist wishes to use trichloracetic acid in 20 or 30 per cent concentration, with a little chlorbutanol added, he should do this with the understanding of what is contained in the preparation, and such preparations may be filled by a competent pharmacist, or even by himself. In other words, Mercitan fluids are prescriptions covered by a protected name.

The Mercitan cream, as can be seen from the composition, is of a shot-gun nature. It contains, according to the firm's statement, three mercury salts and iodine monochloride (which may be presumed to act as germicides when topically applied), tannic acid (which possesses astringent effects), acetanilid, boric acid and glycerol borate (evidently as a pharmaceutic binder).

Mercitan cream also comes in two strengths—mild and strong. Mercury salts in the form of the chloride, the succinimide and the cyanide have been used from time to time

as germicidal agents in the treatment of gum disease and their use has been enthusiastically mentioned by some, but, several years after their adoption, the enthusiasm wears away. No carefully controlled evidence in the ten years that the Mercitan cream has been on the market has come that the mixture present in it is more efficacious than an ointment containing mercurous chloride or other mercury salts. It is known that when acetanilid is applied to injured tissues, it is absorbed and gives rise to methemoglobin and, if absorbed over a long period, its use may give unfavorable results, and over a period of time, may properly be questioned. The use of such a combination of mercury salts as are present in Mercitan is not justified by any published and authenticated scientific data. While the product is advertised to American dentists as nontoxic, it is listed under the Pharmacy Laws of the United Kingdom as a poison, a contradiction to be explained only by legal requirements.

It is conceivable from what has already been said that occasion might arise on which the use of such a preparation would be dangerous to the patient. A statement of composition does not appear on the label. The name does not describe the composition of this shot-gun mixture. In the absence of authenticated scientific data as to its comparative usefulness or even necessity, the claims must be considered as unwarranted.

In the ten years that the product has been on the market, the firm has not proved the rationality of this shot-gun mixture. In the new advertising, as already mentioned, Mercitan has nine functions. It is a germicide, disinfectant, parasiticide, antizymotic, styptic, astringent, sorbefacient, deodorant, analgesic, and is nontoxic to cell tissue. Thus, we have the ideal method of compounding a shot-gun mixture; i.e., listing a number of desiderata, and including in the product a number of drugs supposed to satisfy each of the desiderata. Drug therapy in modern medicines tends toward simple and direct medication. To reiterate the change to meet the times: When Mercitan was first put out, it was frankly stated to be a product of secret composition. The new adverising states "not a secret" and a qualitative statement of composition is given.

### BACTERIOLOGY OF MERCITAN

Bacteriologic claims made for Mercitan fluid and Mercitan cream are based upon the usual *in vitro* germicidal tests. *Staphylococcus aureus* was used as the test organism and experiments were conducted not only in the commonly used broth medium but also in the presence of pus and of saliva. Both of these materials interfere with the germicidal action. The tests printed in the last advertising pamphlet received by the Council are identical with those in a leaflet published in 1921, and are of interest only if the composition of the two products is the same today as at the time the tests were made. The use of *Staphylococcus aureus* is legitimate since it is one of the more resistant varieties of mouth bacteria. The time intervals for germicidal activity as reported are not those in general use today, and, since they are longer, tend to give the impression of too great activity. It requires a different point of view from that of the Council to accept some of the conclusions drawn from the data presented. The statement "Mercitan retains a high degree of efficiency in the presence of organic matter" is hardly borne out by the comparative data available, although it must be admitted that such general statements depend to some extent on interpretation of results. The following figures are taken from the advertising material and represent the dilutions of the two products at which all the staphylococci were killed in fifteen minutes:

| | Mercitan Cream | Mercitan Fluid | |
|---|---|---|---|
| Organic matter absent | 1:1,000 | 1:250 | Control 2,400,000 bacteria |
| Pus present | 1:500 | not in 1:100 | Control 3,700,000 bacteria |
| Saliva present | 1:200 | 1:50 | Control 1,110,000 bacteria |

In order to be fair, it is necessary to add that some bacteria were apparently killed in much higher dilutions than the foregoing, even up to a 1:10,000 dilution in the case of Mercitan cream, if tested in the "absence of organic matter." The differences reported when pus or saliva is present must be considered large, and are of special significance to the Council. Mercitan fluid has, on the basis of the data available, far less germicidal power than Mercitan cream.

Tests for penetrating ability are generally made through an agar medium. Unless it is shown that comparative penetration through agar is a measure of comparative penetration through body tissues, relatively little reliance can be placed on laboratory tests.

The claim is made that Mercitan is "not toxic to living tissue." Data supposed to substantiate this statement are presented. These are obtained by measuring the increase of tissue growth on exposure to the fluids. Toxic substances would prevent or retard growth. The Council cannot agree with the conclusions drawn in the advertising literature. In all concentrations—from "pure" to a 1:1,000 dilution—of Mercitan cream, tissue growth, on the basis of the figures given, is less than that obtained with controls. With Mercitan fluid, growth is less than the control in dilutions of 1:20 or less. In higher dilutions, growth appears to be stimulated. It is necessary to conclude that Mercitan cream has a toxic effect on tissue and that Mercitan fluid has a toxic effect in concentrations of 1:20 or greater.

SUMMARY

Mercitan cream and Mercitan fluid appear, on the basis of the data presented, to have some germicidal action on *Staphylococcus aureus* and, therefore, presumably on bacteria less resistant than this organism. In the presence of pus or saliva, this germicidal action is greatly decreased. The penetrating power of these products into body tissue has not been determined satisfactorily. Mercitan cream has a toxic action on tissue, whereas Mercitan fluid has a toxic action unless diluted more than twenty times.

Mercitan fluid, mild and strong, and Mercitan cream, mild and strong, are unacceptable (1) because a statement of composition does not appear on the labels; (2) because no tests to determine the composition of the products as they reach the dentist are furnished; (3) because they are advertised with unwarranted therapeutic claims; (4) because the presence of potentially toxic substances is not declared (Rule 7); (5) because the name is irrational and does not express the composition of the product (Rule 8); and (6) because Mercitan cream is an unnecessarily complex and shot-gun mixture, the use of which cannot be considered to be in the interest of the dental profession and the public (Rule 10).

The Council desires to point out that, in the consideration of remedies for trench mouth and pyorrhea, due thought should be given by dentists to the limitations of drugs and the necessity for operative procedures. Until the method of treatment radically changes, it is well to bear in mind that not the drug but the instrumentation is the significant factor.

## ALKALOL—NOT ACCEPTABLE FOR A.D.R.

The Council has authorized publication of the following report.

SAMUEL M. GORDON, *Secretary.*

Alkalol, put out by the Alkalol Company, Taunton, Mass., is advertised to dentists in part with the following claims:

Applied to irritated or inflamed mucous membrane its cleansing, soothing properties assist rather than antagonize Nature's healing methods. Different from the average germicide, Alkalol

does not irritate and consequently deplete cellular tissue, but through hypotonicity and correct physiological balance is capable of absorption and consequent help of tired or exhausted cells to help themselves.

Every one knows osmotic pressure. When this pressure is exerted inward the dictionary refers to the process as "endosmosis." This describes exactly what takes place from the point of view of an anaemic human cell when it comes in contact with the soothing properties of Alkalol.

It is contrary to general knowledge regarding the general factors in osmosis to state that materials from a hypotonic solution would pass through a membrane such as a cell wall. The tendency would be for materials to pass from a cell to the hypotonic solution until the concentration on the two sides of a membrane was approximately equal. Further, what the Alkalol Company means by an "anaemic" human cell is left to them to describe. From the composition of Alkalol as expressed below, it is difficult to see how potassium chlorate could overcome an "anaemic" cell condition, whatever that may mean.

Other similar claims of a loose nature are made in advertising.

### WHAT IS ALKALOL?

Alkalol was examined about sixteen years ago in the A.M.A. Chemical Laboratory. It was reported that Alkalol was a clear, light brown liquid with an aromatic odor, a saline taste and an alkaline reaction to litmus. It contains about 2 per cent of solids, mainly alkali, chlorides and probably potassium chlorate. Eucalyptus, spearmint, cinnamon and vanilla are present, the last probably from Siam benzoin. Small amounts of salicylic and benzoic acid were also found. (*J.A.M.A.*, 65:1665 [Nov. 6] 1915; 48:2175 [June 6] 1907; 61:1812 [Nov. 15] 1913.)

According to tests carried out in 1907, it was found that the action of Alkalol—100% failed to destroy the vitality of *Staphylococcus aureus* after an exposure of four hours (Verhoeff and Ellis: *J.A.M.A.*, 48:2175 [June 6] 1907). This may account for the lack of emphasis on the antiseptic action of the product as advertised today, and the attempt to build a case for the product by reference to generalities on osmosis, hypotonicity, etc.

In view of the inquiries which have been received concerning this preparation, examination was undertaken in the A.D.A. Bureau of Chemistry. From the present examination, it may be concluded that Alkalol is essentially a flavored aqueous solution containing sodium bicarbonate, 1.0 gm.; salt, 0.5 gm.; and potassium chlorate, 0.5 gm. per one hundred cubic centimeters. These conclusions in general confirm the earlier findings. It is apparent that Alkalol is another example of the usual mouth wash. Placing a dash of this and a dash of that in these mouth washes and gargles is simply playing to the gallery. After all, in general, it is not the particular ingredients in mouth washes and gargles, but efficient washing and gargling that is of benefit.

Obviously, a pint bottle, which sells for 85 cents, can be made up for less than one cent.* When it is obtained in this way, the dentist and his patient do not help to defray the amounts that must be spent in keeping the name Alkalol before the public.

The Chemist's report follows:

### ALKALOL

Two (2) original packages of Alkalol (The Alkalol Co., Taunton, Mass.), price 85c each, were purchased on the open market.

The following appeared on the package:

*If one desires an alkaline solution of sodium chloride, the following formula (from "Hospital Practice for Internes," A.M.A. Press, 1932, p. 407) is as good as any:

| | |
|---|---|
| Sodium chloride | 4 gm. |
| Sodium bicarbonate | 2 gm. |
| Water, sufficient to make 500 c.c. | |

An alkaline and saline solution for local application. Non-irritant. Soothing and cleansing. 0.05% alcohol.

Each package contained 490 c.c. (approximately 1 pint) of a clear, light brown liquid with an aromatic odor suggestive of eucalyptol and other essential oils, and a saline taste. The solution reacted slightly alkaline to litmus. The specific gravity was 1.014 at 23 C.

During the evaporation of Alkalol, odors resembling those of eucalyptus, spearmint, cinnamon, etc., were noted. Finally, only a vanilla-like odor remained. In view of the color and the vanilla-like odor, it may be concluded that some substance of the nature of Siam benzoin is present.

Qualitative tests indicated the presence of carbon dioxide, apparently present as bicarbonate, chloride, chlorate and a small amount of sulphate, sodium and potassium, and phenolic bodies (salicylates). Other metals were not found.

Quantitative determination yielded the following:

| | |
|---|---|
| Total solids (100 C.) | 1.95 gm. per 100 c.c. |
| Ash (500 C.) | 1.71 gm. per 100 c.c. |
| Sulphated Ash | 2.05 gm. per 100 c.c. |
| Chloride ($Cl^-$) | 0.32 gm. per 100 c.c. |
| Chlorate ($ClO_3^-$) | 0.37 gm. per 100 c.c. |
| Sodium carbonate ($Na_2CO_3$) | 0.16 gm. per 100 c.c. |
| Sodium bicarbonate ($NaHCO_3$) | 0.87 gm. per 100 c.c. |

From the foregoing, the essential composition of Alkalol may be calculated as follows:

| | |
|---|---|
| Sodium bicarbonate | 1.00 gm. per 100 c.c. |
| Sodium chloride | 0.5 gm. per 100 c.c. |
| Potassium chlorate | 0.5 gm. per 100 c.c. |

## ZI-O-DINE ASTRINGENT—NOT ACCEPTABLE FOR A.D.R.

The Iodine Products Company, Laurel, Miss., market Zi-O-Dine Dental Cream and Zi-O-Dine Astringent. Zi-O-Dine Dental Cream was the subject of a notice of judgment (No. 17927) under the Food and Drugs Act. The courts upheld the charges of the Department of Agriculture that the product was adulterated in that it was not antiseptic and prophylactic as claimed and misbranding was alleged in that the statements regarding the curative or therapeutic effects: "You won't have False Teeth if you start using Zi-O-Dine Now. Heals Bleeding Gums," "Checks Pyorrhea . . . Prevents Decay," "Zi-O-Dine is Guaranteed to Prevent Bleeding Gums" and "At each use, a small but effective amount of medication penetrates to the infected area inactivating germs and healing tissues," were held to be false and fraudulent since the examination by the Government chemists indicated that the article possessed no ingredient or combination of ingredients capable of producing the effects claimed.

Analysis by Government chemists showed that Zi-O-Dine Dental Cream consisted essentially of calcium carbonate, magnesium carbonate, soap, glycerine, small proportions of zinc iodide, peppermint oil and methyl salicylate, alcohol, and water, and the article was not antiseptic.

Inquiries have been received concerning Zi-O-Dine Astringent. Accordingly, original packages were purchased and subjected to examination. Chemical examination, as shown in the report of the A.D.A. Bureau of Chemistry appended below, indicated that Zi-O-Dine Astringent was essentially an approximately 9 per cent solution of zinc iodide in a

medium of alcohol and essential oils, such as oil of peppermint, oil of wintergreen and oil of cloves. The principal label states that the preparation contained 80 per cent of alcohol; whereas, the report of the A.D.A. Bureau of Chemistry shows approximately 41 per cent.

Zinc salts, such as the chloride, the sulphate and the iodide, have been used as astringents in the treatment of the soft structure for long periods. One of these preparations is Talbot's Iodo-glycerol and a number of formulas appear in the textbooks.

The Iodine Products Company has not made available evidence that zinc iodide dissolved in a mixture of essential oils possesses any advantage over a simple solution of zinc iodide in glycerine, or even an aqueous medium. Zinc iodide was official in U.S.P. VIII, but it has been discontinued from U.S.P. IX and U.S.P. X. The local actions of zinc salts are essentially the same. They are all protein precipitants. Although the iodide is not official in U.S.P. X, it appears to be preferred by dentists because of its "stimulating" effect, a term which needs further clarification. The statement "If the dentist fails to see results that are satisfactory from the use of Zi-O-Dine Astringent, his money will be refunded by the manufacturer" is objectionable because it implies that the product is generally applicable in the treatment of dental disease; a claim which is unwarranted from the known actions of zinc salts.

The Council declares Zi-O-Dine Astringent inadmissible to A.D.R. because a statement of composition is not furnished on the label and the amount of alcohol declared does not agree with the findings (Rule 1); because claims which are not supported by adequate evidence are made (Rule 6); because the name is noninforming as to composition and the firm is not entitled to a proprietary name for a mixture of well-known drugs (Rule 8), and because a mixture of zinc iodide in essential oils is not known to be more efficacious than a simple aqueous solution (Rule 10).

ZI-O-DINE ASTRINGENT

Six original packages of Zi-O-Dine Astringent (The Iodine Products Co., Laurel, Miss.) were received for examination.

The following appeared on the label:

Zi-O-Dine Astringent. For diseased gums. (Wilson) Manufactured by the Iodine Products Co., Laurel, Mississippi. Alcohol 80%.

[This last statement was stamped in red ink across the label.]

Directions for gum treatments—Dry surfaces to be treated. Wet small twists of cotton in Zi-O-Dine Astringent. Pack and leave them in the free margin of the gums. Then rinse the gums (for this Dakin's Solution is recommended.) Repeat treatment every four or five days, giving thorough prophylaxis in cases of Pyorrhea.

Essentially the same appeared on the carton, and in addition the following:

Zi-O-Dine Astringent is not an escharotic; its iodides, menthol and analgesic oils give it a marked healing property. It may be used on small cuts and scratches just as tincture of iodine is used. It may be used for swabbing sockets after the extraction of teeth. . . . If the dentist fails to see results that are satisfactory from the use of Zio-O-Dine Astringent his money will be refunded by the manufacturer.

The contents of the six bottles was bulked for examination. The liquid was yellow and had an acid reaction to litmus, a specific gravity of 0.966 at 20 C. and a refractive index of 1.432 at 20 C. Distillation indicated 80 per cent distilling over the boiling point range of 78.5-197 C.

Qualitative tests indicated the presence of ethyl alcohol, essential oils (oils of peppermint, cloves and wintergreen), zinc and iodide. Heavy metals (except zinc), sodium, potassium, benzyl alcohol and alkaloids were not found.

Quantitative examination yielded the following:

| | |
|---|---|
| Alcohol | 41.5% by volume |
| Total essential oils | 42.5 c.c. per 100 c.c. |
| Essential oils soluble in 5% potassium hydroxide | 17.0 c.c. per 100 c.c. |
| Methyl salicylate U.S.P. | 10.0 c.c. per 100 c.c. |
| Zinc ($Zn^{++}$) | 1.89 gm. per 100 c.c. |
| Iodide ($I^{-}$)* | 7.51 gm. per 100 c.c. |

On the basis of the foregoing, the following composition may be calculated for Zi-O-Dine Astringent:

| | |
|---|---|
| Alcohol | 41.5 c.c. per 100 c.c. |
| Oil of peppermint | 25.5 c.c. per 100 c.c. |
| Oil of wintergreen | 10.0 c.c. per 100 c.c. |
| Oil of cloves | 7.0 c.c. per 100 c.c. |
| Zinc iodide | 9.23 gm. per 100 c.c. |

Twenty-five cubic centimeters of a mixture having the essential properties of Zi-O-Dine Astringent may be prepared by mixing together 10.8 c.c. of alcohol, U.S.P., 6.4 c.c. of oil of peppermint, 2.5 c.c. of oil of wintergreen (Betula lenta), 1.7 c.c. of oil of cloves, 2.4 gm. of zinc iodide; diluting to 25 c.c. with distilled water. A mixture prepared in this way was found to be yellow and have an acid reaction to litmus, a specific gravity of 0.983 at 20 C. and a refractive index of 1.438 at 20 C. A determination of the essential oils in the same manner as was done for Zi-O-Dine yielded 43 c.c. of essential oils per hundred cubic centimeters of samples.

*The amount of iodide found was somewhat higher than that required by zinc to make zinc iodide. This is not surprising since it has been found that, when alcoholic solutions of zinc iodide are prepared, a small flocculent precipitate separates, leaving excess iodine in solution.

## ACCEPTED DENTAL REMEDIES

The following article has been accepted as conforming to the rules of the Council on Dental Therapeutics of the American Dental Association. The Council desires dentists to understand that the admission of an article does not imply a recommendation. A copy of the rules which govern the Council in the consideration of articles will be sent on request.

SAMUEL M. GORDON, *Secretary.*

### DENTIFRICES*

**Williams' Dental Cream.**—Composition: Each 100 gm. is stated to contain starch, 6.0 gm.; glycerine, 32.0 gm.; precipitated chalk, 36.0 gm.; water, 20.0 gm.; soap, 5.5 gm.; flavoring oils (peppermint, menthol, anethol), 0.5 gm.; saccharine, 0.01 gm.

CLAIMS: No claims, except that it is an effective cleansing agent for the teeth, are made.

Manufactured by the J. B. Williams Company, Glastonbury, Conn.

*Accepted Dental Remedies, p. 83.

# THE COUNCIL ON DENTAL THERAPEUTICS AIDS THE DENTAL PROFESSION BY:

1. SUPPLYING UNBIASED INFORMATION IN THE FIELD OF DENTAL PROPRIETARY REMEDIES.
2. FURTHERING THE RATIONAL USE OF DRUGS IN DENTISTRY.
3. FOSTERING THERAPEUTIC RESEARCH.
4. ENLISTING THE COOPERATION OF MANUFACTURERS OF WORTHY DENTAL PRODUCTS.

## THE WORK OF THE COUNCIL FALLS INTO TWO DIVISIONS:

### CRITICAL

1. Rejects unworthy proprietaries. *(and tells the profession why.)*
2. Disapproves the use of irrational mixtures. *(and tells the profession why.)*
3. Condemns exaggerated claims. *(for the benefit of the profession)*
4. Discourages the use of therapeutically suggestive, meaningless or misleading names. *(for the benefit of the profession.)*

### CONSTRUCTIVE

1. Accepts worthy proprietaries. *(and tells the profession why.)*
2. Encourages the use of drugs of proven worth. *(and tells the profession why.)*
3. Encourages the use of correctly descriptive drug names. *(for the benefit of the profession.)*
4. Will evaluate established drugs. *(for the benefit of the profession.)*

**This and the chart on the following page are part of an exhibit of the Council on Dental Therapeutics presented at the St. Paul Session, Aug. 6-10, 1934.**

# UNWARRANTED CONDITIONS ... *THE REMEDY*

ALTHOUGH THE NUMBER OF MERITORIOUS PRODUCTS AVAILABLE TO DENTISTS IS INCREASING, A LARGER NUMBER OF PRODUCTS WITH NO MERIT ARE BEING EXPLOITED. THERE ARE TWO TYPES OF FIRMS THAT HINDER RATIONAL THERAPY:

A. Those that let not their left hand know what their right doeth; and sell both worthy and unworthy products.

B. Those whose business and scientific ethics are still in the formative stage.

| WHAT ARE THE STANDARDS OF: | THESE STANDARDS CAN BE RAISED BY: |
|---|---|
| 1. Houses that sell unworthy products ? | 1. Dealing with firms that show evidence of being in sympathy with scientific dentistry. |
| 2. Dental Journals that advertise unworthy and already exposed products. | 2. Pointing out to editors that their advertising pages are unfair. |
| 3. Dentists who indiscriminately use unworthy or exposed products ? | 3. Limiting drug usage to U·S·P and honestly advertised products. |

WRITE TO THE COUNCIL FOR UNBIASED INFORMATION.

# BUREAU OF PUBLIC RELATIONS

## LESSONS TO BE LEARNED IN A CHILDREN'S DENTAL CLINIC*

By JOHN OPPIE McCALL, D.D.S., F.A.A.P., F.A.C.D., New York City

THE Murry and Leonie Guggenheim Dental Clinic was founded in December, 1929, and began operation at that time with a two-chair equipment at 1292 First Avenue, New York City, a full-time dentist and a full-time dental hygienist being in charge. This initial "experimental" clinic offered free dental care to needy children in the kindergarten and eight grades of Public School 82, near which it was situated. This provided an opportunity to make a first-hand study of the dental needs of the child population in the upper East Side, one of the poorer districts of New York City, in which it was proposed to locate the building that would finally house the clinic.

The five-story building now occupied by the clinic and its school for dental hygienists was completed in the fall of 1931, at which time service on a larger scale was inaugurated.

On the technical side, a program has been established that is based on assumptions widely accepted in the dental profession regarding dental disease and having as its objective the maintenance of oral health in the patients served, from the time of the completion of the eruption of the deciduous tooth to 14 years, the average age for graduation from public school. A secondary, but important, objective was to determine clearly the dental condition and needs of the child population of New York City and the most economical method of giving effective dental service to children, with the assumption that information so developed would be helpful in the setting up of other dental programs in urban communities. The program now being followed has as its base a visit to the clinic by each child at six-month intervals for such attention as is needed, this care being continued throughout the age period just mentioned. To successfully carry out this program requires restriction of admissions, the number of children who may be cared for varying in inverse ratio to the number of visits per child needed in the beginning and at each recall.

In 1933, 9,404 patients made 62,695 visits to the clinic. Of these, 4,074 were new patients; and 16,890 visits were made to the department of oral diagnosis. Each new patient, in addition to the usual examination, is given an adequate roentgen-ray survey. Recalled patients are examined clinically semiannually and by roentgen-ray annually. A special count of cavities in the teeth of recalled patients is made in order to estimate the success of the program.

*From the Murry and Leonie Guggenheim Dental Clinic.

*Read before the Section on Mouth Hygiene and Preventive Dentistry at the Seventy-Sixth Annual Session of the American Dental Association, St. Paul, Minn., Aug. 8, 1934.

Dental disease is rampant in America, especially among the urban population. The seriousness of the situation is emphasized by the fact that the condition is highly prevalent among children, even among very young children. Figures compiled at the Guggenheim clinic show that 98.2 per cent of the children examined there are affected by dental decay. An equal number have varying degrees of gingivitis. While we may expect these high percentages in school children on the basis of past experience, we are somewhat unprepared for the high percentage of preschool children showing caries; a situation having even more serious potentialities. The figures are given in tabular form.

| Age Years | No. of Patients | Per Cent with Caries |
|---|---|---|
| 2 and under | 47 | 53 per cent: 36 per cent with from 1 to 6 cavities; 17 per cent with from 7 to 17 |
| 3 | 232 | 81.5 per cent: 42.5 per cent with from 1 to 6 cavities; 39 per cent with from 7 to 20 |
| 4 | 499 | 92 per cent: 35.5 per cent with from 1 to 6 cavities; 56.5 per cent with from 7 to 32 |
| 5 (from Jan. 1, 1933) | 311 | 97 per cent: 35.5 per cent with from 1 to 6 cavities; 61.5 per cent with from 7 to 41 |

Due allowance should be made for the fact that the number of children is relatively small. That the figures are fairly reliable is borne out by the dental condition of the children who have just reached kindergarten age, of whom large numbers are examined each year and a proportionately high percentage are found to have caries.

Beginning dental treatment at an early age, preferably 2 years, is prompted by the figures on the incidence of caries in those already examined; by the opportunity thus presented to prevent caries or greatly minimize its incidence and spread; by the economy of such a program of prevention and conservation, and by the fact that, almost without exception, the very young patient is the best patient.

Dentists have for many years sought the answer to the riddle of dental decay. Up to date, the solution has evaded them although impressive partial success has, in late years, been achieved. In the latter part of the last century, W. D. Miller definitely established the fact that decay starts on a tooth surface to which has become attached a colony of acid-forming bacteria. Such a surface is at least technically an unclean surface, and the realization of this fact, together with its logical complementary implication, led to the formulation of the familiar slogan that a clean tooth never decays. The acceptance of this concept led to advanced efforts in tooth cleaning, and culminated in many states in the training and legalization of dental hygienists. While efforts to prevent decay by tooth cleaning have not resulted in 100 per cent success, the part played by the prophylactic treatment and by strict attention to home care of the mouth in the prevention of dental disease is both impressive and encouraging. It forms the backbone of the preventive program at the Guggenheim clinic.

In recent years, the belief has been gaining ground, supported by much laboratory and clinical research, that dental caries is directly controllable by dietary means. What is needed, if prevention is to be accomplished by such means, is a closer approach to agreement among research workers as to which element or elements in the dietary are most potent in controlling dental decay and the economical production and distribution of

the desired articles of food; and an intensive nation-wide campaign of education intended to induce the population generally to adopt the recommended diet.

Such information as is now available regarding diet and oral health indicates that a fully protective diet varies widely from the average American dietary both in the inclusion of certain foods and the exclusion of others. Efforts to secure the adoption of recommended dietaries in individual homes have met with little success. American food habits are deeply ingrained, and tastes acquired for white bread and other refined flour products, white sugar and the foods and desserts in which it is used, are difficult to change.

At the Guggenheim clinic, no general educational program on diet and nutrition is carried on. The clinic cooperates with the health education department of the board of education in this regard. Special health education teachers give instruction in all health matters in the public schools; and it is the belief of the clinic administration that instruction regarding diet, because of the fact that diet necessarily influences the health of the entire body and not the teeth alone, should be given as a general health lesson. The teachers of this subject emphasize, of course, the close relationship between diet and dental health. In addition to this, mothers are called to the clinic for consultation on diet in special cases.

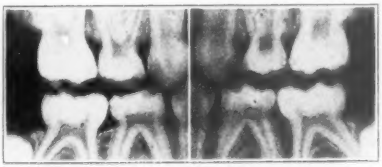


Fig. 1.—Early proximal caries of the lower left first deciduous molar in a child, aged 4. The teeth are apparently free from caries as judged by mouth mirror and explorer examination.

The program at the Guggenheim dental clinic is as follows: An examination is made which, as stated before, includes for each child a minimum roentgen-ray survey made with bite-wing films showing the crowns of the posterior teeth. Then a prophylactic treatment is given. In the clinic, there is conducted a school for dental hygienists, the class work being carried on in rooms set aside for this purpose in the clinic building. The prophylactic treatment of the children in the clinic is given by student hygienists. These students are also assigned to the diagnostic department in rotation, where they examine patients and take roentgen-ray films under supervision. Following the prophylactic treatment or at a subsequent appointment, according to the time available, the child is taken to the toothbrush drill room. Here each child is provided with a suitable brush and, under the supervision of the dental hygiene student, learns the accepted technic, which is that advocated by Fones. This drill is repeated at subsequent visits until the technic has been mastered.

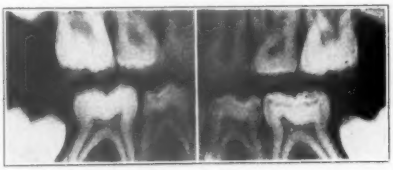


Fig. 2.—Caries in a child aged 5 originating on proximal surfaces of deciduous molars. There is no primary occlusal caries.

It will be noted that the dental hygienist plays a rather prominent part in the program so far. This is because we are satisfied as to the importance of two things in the preventive dental program: the prophylactic treatment and a correct toothbrush technic. For the first, repeti-

tion at least every six months is needed. More frequent treatment is often indicated. For the second, massage of the gums is emphasized. Few appreciate what the toothbrush is capable of doing in reducing both dental caries and disease of the gums, when used with a technic which will produce the highest degree of circulatory stimulation in the gums at the same time that the teeth are being brushed. To teach this technic and to arouse the interest and cooperation of the patient is an assignment for which the hygienist is very well adapted. Her ability as a conscientious and capable operator in the field of the prophylactic treatment is well known. In fact, the chief shortcomings of the dental hygienists as a group have been imposed on them by the dentist in failing to utilize their services to the best advantage.

Returning to the clinic routine, the roentgen-ray films are surveyed either by the dentist in charge of the diagnostic department, by the supervisor of the operative clinic or by me. Teeth definitely unsavable are charted for extraction. The roentgen rays are a great help in making these decisions.

Fillings are then placed in savable teeth; and every savable tooth, whether deciduous or permanent, is restored with a permanent filling, amalgam or silicate. This procedure does away with constant replacement of cement, avoids danger of pulp infection due to leakage at gingival margins and retains occlusal height. Extractions are postponed until fillings are completed unless conditions require earlier reference to the surgery department. Finally, another prophylactic treatment is given if the operative work has been at all time consuming. The patient is then examined by the supervisor or by me and the case checked as completed.

There is another field in which the dental hygienist is soon to assume a position of great importance, i.e., the hospital. In 1927, the late S. W. A. Franken, chief of the dental service at Lenox Hill Hospital, New York City, put into effect a preoperative prophylactic program for all surgical cases when time would permit this service, the object being to cut down postoperative pneumonia and hasten convalescence. Prophylactic treatment and rigid mouth cleanliness, together with frequent use of strongly antiseptic mouth washes, were the foundation of this prophylactic care. Included, as far as conditions would permit, was the extraction of infected teeth. The results were striking. Postoperative pneumonia dropped from the previous low of 2.5 to 0.7 per cent, a figure which was maintained for several years. Recently, this has been reduced still more. For the past year, student hygienists from the Guggenheim school have been giving prophylactic service at the Lenox Hill Hospital, under compe-

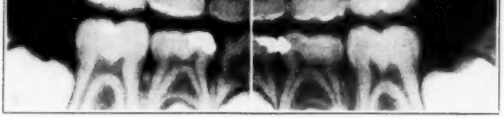


Fig. 3.—Caries in a child aged 8 originating on proximal surfaces of deciduous molars. There is no primary occlusal caries except in the permanent molars.

tent supervision, as a part of their training, this service thus being extended to a larger number of patients. The figures for 1931-1933 were 800 cases of anesthesia with only one case of postoperative pneumonia, this case having an exceptionally long anesthesia. The benefits to the patient, which are obvious, and the shortening of the patient's stay in the hospital, which is important from the standpoint of economy, make the extensive utilization of prophylactic service in the hospital almost mandatory.

Observation of caries in the teeth of school children and older persons has emphasized beliefs previously voiced as to the susceptibility to caries of the surfaces in which anatomic defects occur. Hyatt has submitted statistics proving the liability to decay on those surfaces and he has advocated prophylactic odontotomy as a means of preventing caries in such areas, with presumptive protection of the entire tooth thereby. I have approved of his fundamental theory and plan of action, but have questioned the criterion which he formerly advanced for the selection of areas to be so operated on, namely, the "sticking," or penetration, in the fissure, of a fine pointed explorer.

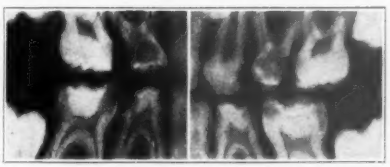


Fig. 4.—Deep carious involvement of all deciduous molars in a child, aged 5. There is caries of the deciduous cuspids. The roentgen-ray film indicates the depth of penetration of the caries toward the pulp. All of the molars are hopelessly involved except the upper left and lower right second molars, which are doubtful.

In the effort to develop a better means of diagnosis, we have used ammoniacal silver nitrate reduced with eugenol as a disclosing agent. This method has been used by Bödecker. When this combination is applied to the occlusal surface of a molar, the surface having first been dried carefully, there is a definite penetration of the silver salts into any fissure or pit even if too small to admit an explorer point.

The reading of the resulting stain is not made at the time of application, but several days later, after the superficial deposit of silver has been worn away by food scouring. At this time, the tooth is inspected for shade and breadth of staining. A fine light brown line is considered to be an indication of satisfactory enamel lobe coalescence and sound enamel structure. On the other hand, a dense black line of appreciable width is usually found to indicate imperfect or

Fig. 5.—Premature loss of all deciduous molars in a child, aged 5, as a result of caries.

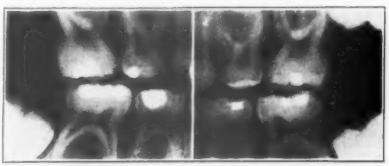


Fig. 6.—Type of case seldom seen. Occlusal caries only in the deciduous molars in a child, aged 5.

even softened enamel. Such areas are always cut out and fillings inserted therein.

We have found that even when enamel structure is apparently sound as indicated by this test, caries may occur later on.

Observation of teeth in which this happens shows an anatomic form of the occlusal fossae that favors food retention. Hyatt has called attention to the angles produced by the cusp surfaces as they meet in the fossa. Sharp angulation favors food retention, and we are now adopting a policy of filling food retentive fissures even when there is no evidence of imperfect coalescence of the enamel lobes; even when the explorer does not stick and when the silver nitrate does not stain deeply.

of the patient, but a large number were teeth previously examined and deemed at the time not liable to caries. We are therefore modifying our policy in conformity with these findings, as previously noted.

While our experiences bear out Hyatt's contentions as far as permanent teeth are concerned, very nearly the opposite situation is encountered in the deciduous dentition. Because of extensive destruction of deciduous molars, frequently found at the time of first examination in children of school age and even below that age level, it is not possible to furnish reliable figures on the relative incidence of decay in occlusal and proximal surfaces of these teeth. I believe it is safe to predict that fully half of the

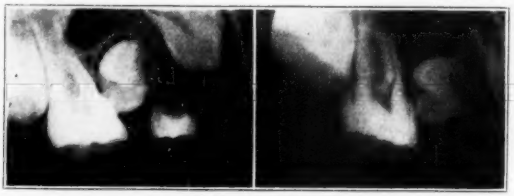


Fig. 7.—*a*, premature eruption of bicuspids in a child aged 8, due to loss of deciduous molars. *b*, same case four months later. The first bicuspid was exfoliated spontaneously owing to lack of root and peridental membrane development. The second bicuspid is in malposition.

Evidence of the need for the protective filling of such areas is seen in the figures on new caries in recalled patients. It will be remembered that patients, after having all necessary dental work done, are recalled in six months for oral prophylaxis and examination and that new bite-wing roentgen-ray films are taken at every other recall. For the first six months of 1934, occlusal surfaces of bicuspids showed 539 carious cavities, while proximal surfaces had 177 cavities, and occlusal surfaces of molars showed 2,558 carious cavities as against 229 cavities in proximal surfaces. Many of these teeth were newly erupted, since the last visit

caries found in deciduous molars originates in proximal surfaces. This means, in a word, that we cannot expect to protect these teeth by prophylactic odontotomy in so high a percentage of cases as in the permanent posterior teeth. We are at present assuming that the occurrence of caries in the proximal surfaces of deciduous teeth, and for that matter in permanent teeth, is rather directly related to circulatory deficiency in the interproximal gingival tissue. Our efforts toward prevention of interproximal caries are directed toward stimulation of the gingival circulation by intensive toothbrush massage. Findings so far

available encourage us to continue efforts along this line.

I have previously said that local dental care, with special emphasis on periodic prophylactic treatment and vigorous gingival massage by means of the toothbrush, is the backbone of the preventive program at the clinic. It is not possible to say, in three years' time, what measure of success is attending the operation of this program, but the figures on new caries in recalled cases are interesting and possibly significant.

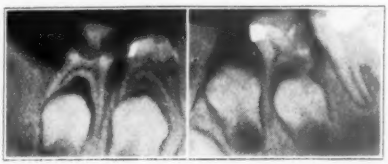


Fig. 8.—Dento-alveolar abscess of lower second deciduous molars in a child, aged 7. Rarefaction is found in the bifurcation instead of at the root ends. This is an invariable finding in pulp canal infections of the deciduous molars.

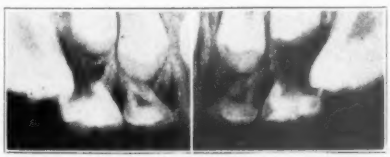


Fig. 9.—Absorption of disto-buccal and lingual roots of upper second deciduous molars, with impaction of first permanent molars in a child, aged 6¾. Dento-alveolar abscesses have developed owing to invasion of bacteria into pulp canals through the gingival crevice. The cause is apparently insufficient growth of the maxilla to permit the eruption of the permanent molars in their proper position.

In 1933, of 3,750 recalled cases, 633 needed no operative treatment, three previously free from caries remained in that state, and in 3,111 cases, there were 7,676 new cavities, or an average of 2.4 for each child in the latter group. Corresponding figures for the first six months of 1934 are 2,307 recalled cases, of which 228 needed no operative work and seven continued free from caries. There were 4,627 new cavities found in 2,072 patients, an average of 2.2 per child. The figures are more impressive than appears on the surface. A large number of these new cavities have been of the pit and fissure type, as we have already seen. If we segregate these cavities as naturally susceptible areas, for which prophylactic odontotomy offers at present the only effective protection, the new cavities remaining that were found so far in 1934 average only 0.7 cavities per child.

A study of 1,000 consecutive cases from the files of the clinic was made recently to determine the average number

Fig. 10.—*a*, case similar to that shown in Figure 9 in a child, aged 8, except that spontaneous jaw growth occurred, permitting normal eruption of the permanent molar before serious damage was done to the deciduous molar. *b*, same case three months later, showing filling in of bone where root absorption had occurred. There is beginning calcification of the second bicuspid crown.

of treatments required to complete needed dental work, at each age level, for children who had had no previous dental care. This was intended to bring out the element of the extensiveness of caries involvement as compared with the incidence which is shown as a result of mouth examination. The cases were further subdivided as to the nationality of the parents. Most children in the district served by the clinic were born in this country, but a large proportion of the parents were born in other countries.

It was found in a preliminary survey of the figures that very few children needed less than ten visits for completion of dental work, and a calculation was therefore made on the basis of parents' nationality as to the proportion of children needing ten or more visits. The results follow: Slovak, 93.5 per cent; mixed (father and mother of different nationalities), 93 per cent; American, 91.5 per cent; Italian, 89 per cent; German, 89 per cent; other nationalities, 88 per cent. It is believed that a difference of 5 per cent between the highest and lowest is not enough to warrant a statement that incidence and severity of carious involvement vary according to heredity influence as related to the nationality of the parents. In grouping the children below 6 years of age, it was found that only 75 per cent of all nationalities represented needed ten or more visits for completion.

The general average of visits needed for completion for children of all ages is 15. A calculation was next made as to the proportion of children above and below the age for entering school requiring sixteen or more visits for completion of dental work. It was found that 56 per cent of the children 6 years and older were in the group requiring this large number of visits, while only 37 per cent under 6 required more than fifteen visits for completion.

The number of visits tends to increase with age up to 9 years. After that, there is a slight drop. This, of course, does not mean that the condition of the teeth improves with age, but that a larger number of teeth are found to be unsavable, and thus extractions are substituted for filling operations, with a natural diminuation in the number of visits needed.

The object in presenting these figures is to emphasize the need for starting dental work at an early age, a point already brought out in the figures as to the incidence of caries by ages. They are of further interest to those charged with developing dental projects under municipal or other auspices. The added cost of admitting older children to municipal dental service, as compared with starting with young patients and keeping their mouths in good condition, is shown by

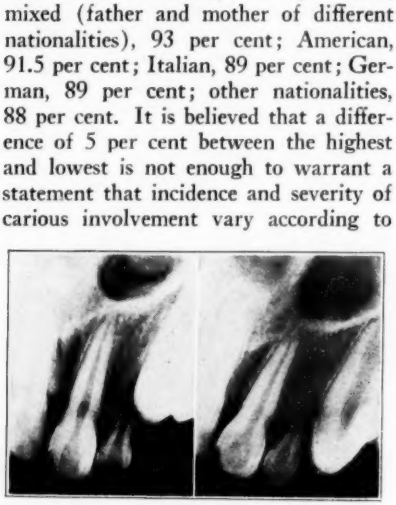


**Fig. 11.—Absorption of root of upper deciduous lateral, in a child, aged 10¼, due to encroachment of permanent cuspid. There is congenital absence of the permanent lateral incisor. *b*, same case fifteen months later. Spontaneous jaw growth has permitted the cuspid to erupt in its proper position. There is filling in of bone where absorption had occurred.**

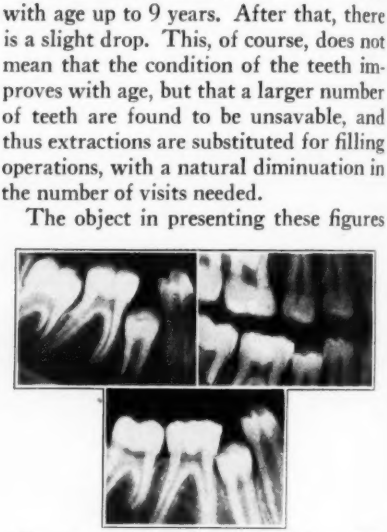


**Fig. 12.—*a*, partial impaction of lower left second bicuspid due to drifting of adjacent teeth after premature loss of second deciduous molar, in a child, aged 11. *b*, same case at the age of 12. There is continued eruption of the second bicuspid due to spontaneous jaw growth. *c*, same case at the age of 13. The second bicuspid has almost completely erupted.**

the number of visits required for those who run over the average. A large number of children require as many as twenty-five visits and the number has ranged as high as forty-four for one 9 year old child.

In the American-parentage group, the largest one having 270 children, 130 children of all ages made fifteen visits or less each, the total visits for the 130 children being 1,475. The remaining 140 children required sixteen or more visits each. The visits of this group of 140 totaled 2,888. The cost of giving dental service to children whose mouths have been allowed to get in bad condition because dental care was not started at an early age is thus seen to be truly staggering.

This brings up the question of the cost of treatment. During 1932, which was the first complete year of operation of the Guggenheim clinic, the cost for all types of work done in this clinic was $15.20 per child for the year. This figure was quite high because a large number of these cases were new and many operations were required on the average per child. The cost per visit was $1.86⅘.

These figures include all expenses connected with the operation and administration of the clinic. They include replacements and repairs on operative equipment, also insurance, such as employers' liability. They do not include taxes and water rent, from which the clinic is exempt; nor do they include depreciation and interest charges on the building. The figures include the cost of oral diagnosis, including roentgen-ray work, which is carried on in a separate department, and oral surgical operations. In these departments, the time spent is not tabulated as is done in the operative department. The cost cannot therefore be reduced to an hourly basis.

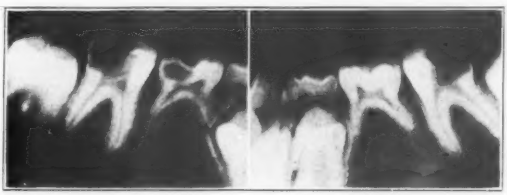


Fig. 13.—Congenital absence of lower second bicuspids in a child, aged 9. Condensing osteitis at the distal apex of the left second deciduous molar is due to low grade pulp infection. The tooth is still vital. There is partial root absorption although the permanent successors are absent.

As a means of further emphasizing this point, it may be stated that for recalled patients, showing an average of two cavities per child, regardless of age, an average of not more than four visits is required to put the mouth in good condition again. The four visits will cover examination and prophylaxis as well as filling the carious cavities. If dental care is started when the number of cavities is small, not only is the expense of first treatment kept at a low level, but later treatment is also economical, as just indicated. Starting prophylactic treatment before cavities form is even better economy.

In 1933, the cost per patient was $10.29. This is due in part to the reduction in the average number of visits because nearly half of those treated were recalled patients. It was also brought down somewhat by reductions in operating expenses, forced by the depression. The cost per visit in 1933 was $1.54.

The roentgen-ray survey, instituted as a routine part of the examination program, has proved itself an indispensable aid in planning correct operative and surgical procedures. It is unnecessary to stress its value in the early detection of proximal caries, as this is universally accepted. What is equally important is the information the roentgen-ray films give as to the degree of penetration of caries, both proximal and occlusal. With its aid, it is possible to determine pulp involvement, which otherwise could only be discovered by time-consuming and frequently painful excavation of carious tooth structure. The saving in time, and wear and tear on the patient's nervous system, more than justifies the slight expense involved. In addition, it enables the operator to detect symptomless dentoalveolar infection, congenital absence of permanent teeth, the rate of absorption of deciduous roots, etc.

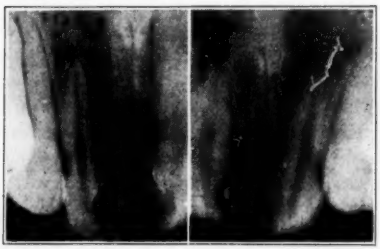


Fig. 14.—Congenital absence of upper permanent central incisors in a child, aged 14. The decayed deciduous central incisor has undergone root absorption although its permanent successor is absent. The central incisor space has closed up.

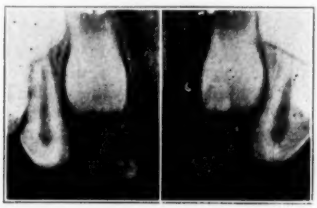


Fig. 15.—Congenital absence of deciduous lateral incisors in a child, aged 6. All other deciduous teeth are present and free from caries.

Incidentally, asymmetrical absorption of deciduous molar roots is often found to be the cause of delayed exfoliation of these teeth and delayed eruption of their permanent successors. This may be detected by use of the roentgen rays. In fact, the rays will greatly assist those interested in eruption time and will replace speculation as to etiology, with certainty in a considerable number of cases of delayed eruption.

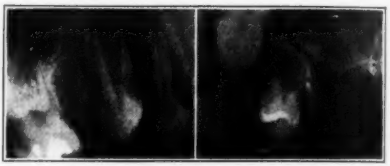


Fig. 16.—Congenital absence of both upper left bicuspids and upper right second bicuspid in a child, aged 6½. The left permanent cuspid is erupting distad from the deciduous cuspid. There is advanced root development of the right bicuspid root.

Fig. 17.—Asymmetric absorption of deciduous molar roots in a child, aged 13; a common cause of retarded exfoliation of these teeth and of malposition of their successors.

The question of space retainers has received much attention in recent years. Consideration of this problem has been forced by the growing incidence of pulp involvement due to caries in deciduous teeth, with corresponding need for ex-

tracting them before their permanent successors are sufficiently advanced in development to maintain the space needed for their eruption. The common experience of closing up of the space created by premature loss of the deciduous teeth, especially the molars, has created a belief that such closure always takes place under the circumstances just mentioned. This is far from being the case.

On the other hand, even when there has been no extraction, there may be sufficient growth of the jaw. This is especially seen in the maxilla, where the first permanent molar may be so crowded that it cannot erupt normally. In these cases, the permanent molar may cause absorption of the distobuccal and lingual roots of the second deciduous molar and become impacted on the crown of that tooth.

The jaws not infrequently retain their mesiodistal dimension or increase it without artificial aid, and instances have been observed wherein space which had been lost was regained later without the insertion of any appliance. Nutritional influences have been difficult to trace in the cases under observation as no special dietary was recommended. It has been possible, in some cases, to associate this growth with improved functional use of the jaws and of the remaining teeth, made possible by filling carious cavities.

The influence of exercise on jaw growth, as exemplified in cases seen at the clinic, should receive serious study. Also, it is important that some method be devised for determining, if possible, where space retainers will or will not be needed before advocating universal adoption of this procedure.

Lack of growth of the jaw may be, and frequently is, associated with teeth of better than average structure and a high resistance to caries. A case seen recently was that of a girl 5½ years of age, free from caries, yet showing not the slightest spacing of the incisors. The patient was of normal skeletal build and

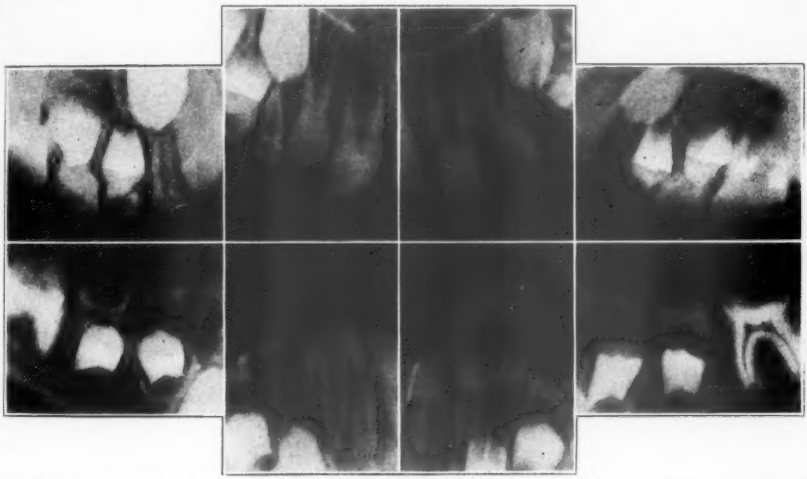


Fig. 18.—Premature root absorption of deciduous molar roots and premature eruption of permanent incisors in a child, aged 5.

appeared well nourished. It is difficult to reconcile a dental condition that seems to indicate a superior calcium metabolism, with a jaw condition that points to an inferior calcium intake and utilization. This paradox was accentuated by the fact that the patient had a Class 2 malocclusion.

The problem of gingivitis and of deeper periodontal disease is one which receives relatively little attention in papers and discussions regarding dental conditions in children's mouths. This is, of course, only because caries so completely overshadows periodontal lesions

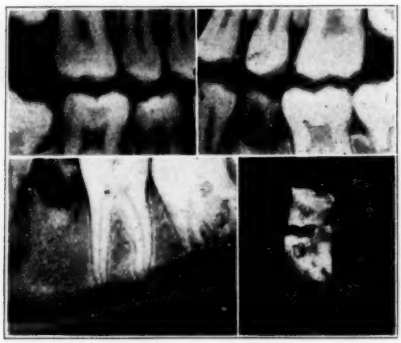


**Fig. 19.—Destruction of crown of lower right second bicuspid apparently superinduced by infection from retained deciduous molar in a child, aged 10½.**

in the minds of both dentists and laymen. Gingivitis of some degree is practically universal in the mouths of the children seen at the Guggenheim clinic. It varies widely in degree and extent. It may involve one or two teeth only and present merely a slight thickening of the marginal gingiva without noticeable redness of this tissue, or it may, at the other extreme, involve every tooth in the mouth in a generalized inflammation, showing marked redness which may extend from the margin of the gingiva over the alveolar mucosa to the mucobuccal fold. Ulcerative inflammations are fairly rare in our experience. Smears from these cases are often characterized by more or less complete absence of the spirochete and fusiform bacillus. The prompt and favorable response of these cases to orange or lemon juice, as part of the treatment, points to the probability that they have a scorbutic basis.

Of the local causes of gingivitis, one of the most common is lack of function or insufficient function. This is exemplified by the case, too often seen, in which sensitive cavities inhibit chewing of food because of the pain involved. This may be either pain in the tooth itself or pain from packing of food against the interdental papilla when proximal cavities face each other in adjoining teeth. The gingivitis proceeds partly from stagnation due to lack of exercise and partly because of the accumulation of infected mucinous débris on the enamel surface contiguous to the gingiva from lack of the cleansing effect of food scouring. In the case of food packing, there is, of course, direct irritation of the gingiva.

Recession of the gingival border is fairly common in the anterior permanent teeth and rare in the deciduous teeth. It is usually associated with traumatic occlusion. Mobility of perceptible degree is also fairly common, being due to the same condition.

Pus pocket formation, on the other hand, is rare, especially around the deciduous teeth. I have seen an advanced case of periodontoclasia in a negro girl of 8, involving chiefly the deciduous molars. The only recognizable systemic shortcoming in this case was a partial antiscorbutic deficiency. There was a slight buccolingual malrelationship of the posterior teeth, but only a slight traumatic occlusion.

Focal infection is virtually *terra incognita* as far as children are concerned.

Comparatively few cases are seen at the clinic in which the presence of oral foci of infection can be definitely associated with any patent systemic disease. Here, as in the case of adults, there is need for the development of precise criteria of health in order that acceptable studies of the possible relationships of focal infection to departures from a state of health may be made. It seems reasonable to suppose that the presencce of oral foci of infection will influence adversely the en-

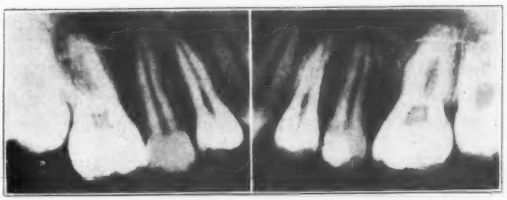


Fig. 20.—Advanced periodontoclasia in upper right and left first molar regions, with absorption of cementum on distal surface of right second bicuspid in a colored child, aged 14.

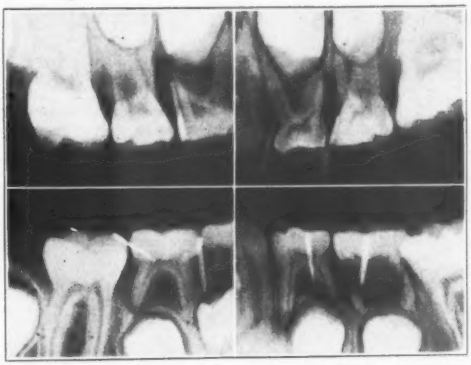


Fig. 21.—Advanced periodontoclasia involving all deciduous molars in a colored child, aged 8. Guttapercha cones were placed in the pockets previous to taking the roentgen-ray films to show pocket depth.

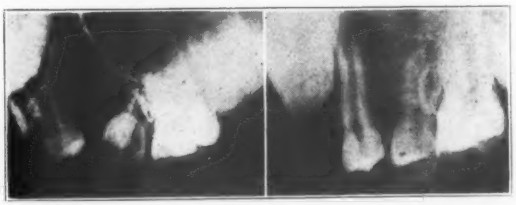


Fig. 22.—*a*, apparent odontoma (tentative diagnosis) between upper right bicuspids in a child, aged 8½, with deflection of bicuspid roots. No operation was performed as the patient refused to go to the hospital as instructed. *b*, same case two years later. There is apparently normal bone between the bicuspid roots, which have come into nearly normal position.

docrine, nervous, hematopoietic, circulatory or digestive systems, and that oral, as well as other, foci should be eradicated for that reason. But at present evidence is lacking as to the nature of such relationship except in such grave conditions as inflammatory rheumatism, chorea and heart disease. Fortunately, the proportionate incidence of these conditions to

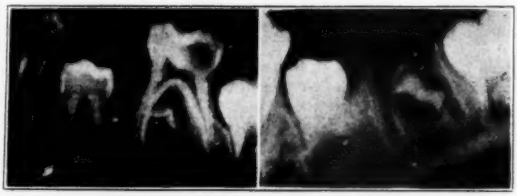


Fig. 23.—*a*, slightly calcified bud of supernumerary bicuspid between roots of lower first permanent molar in a child, aged 9. *b*, same case after extraction of molar, which had developed periapical infection.

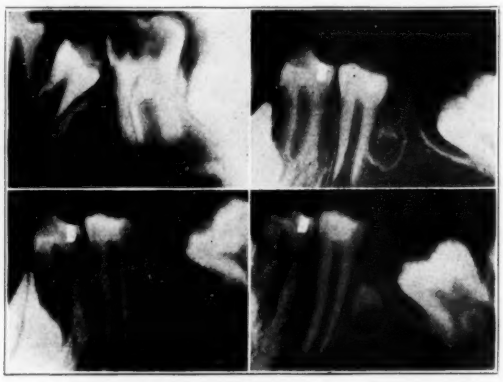


Fig. 24.—Successive views showing development of supernumerary bicuspid over two-year period (age, 8-10). Spontaneous righting of the second bicuspid is evident.

that of obvious oral foci of infection is small.

If any conclusions can be drawn from observation of many children's mouths over the past three years, they are to the effect that local care, conscientiously and continuously applied, is remarkably effective in reducing the incidence of dental caries and gingivitis; that this local care should be initiated at about 2 years of age if it is to result in the greatest good and the greatest economy as to the cost of the dental service involved; that frequent prophylactic treatments, both in their own influence and in the opportunity that they afford for maintaining toothbrush morale, constitute an invaluable part of the scheme for local care, and that dental hygienists, instead of being in a minority, as at present, should well outnumber the dentists in the community if economical dental service is to be offered to the general population. Decay of the proximal surfaces of the deciduous teeth, especially the molars, offers the

greatest present challenge to those interested in preventive dentistry. As regards the possibility of preventing caries by dietary means, I believe this has been satisfactorily demonstrated in many instances, but I believe that the essential nutritional factor has not as yet been demonstrated. Even when this is done, there is considerable doubt as to the ability of those interested to secure the modification of the present-day American dietary necessary for the production of the desired result. Until such modification is attained, we must continue to lean very heavily on local care in our preventive program.

## ACTIVITIES OF THE DENTAL DIVISION OF THE MILWAUKEE HEALTH DEPARTMENT

By L. A. GERLACH,* D.D.S., Milwaukee, Wis.

ALL public health work carried on in any organized community has as its basis prevention. The departments of communicable disease, sanitation, venereal disease and tuberculosis and all other branches of a health department have prevention as their aim. With these facts in mind, and with a full knowledge of what the dental profession has to contend with, it is logical to assume that any dental health project, in order to be constructive and beneficial for generations to come, must be preventive.

Although the aim of prevention is paramount in the dental health program of the Milwaukee Health Department, some provision has been made in the personnel and arrangement to allow for a limited amount of operative work, so necessary for relief of the indigent families. This compares with the situation in the other divisions of the health department.

The communicable disease division has an isolation hospital to receive patients; the tuberculosis division is able to refer patients to a county sanitarium; the school hygiene division is able to refer cases to both a county hospital and a children's hospital, and the venereal disease division is able to refer cases to a county hospital.

As there was not any well organized dental clinic in Milwaukee, city or county, at the time that the dental health program was instituted, it was necessary for the health department to make some provision for emergency dental treatment for the severe cases of infection uncovered in the schools by the oral hygienists. This service was instituted at the earliest possible time after the appointment of the first hygienists. Therefore, at present the dental division of the Milwaukee Health Department consists of the oral hygiene group and the clinic group, both functioning under the dental director, and working hand in hand for a well-rounded dental health program.

The difference between the duties of the oral hygienists and those of the dentists in the clinics makes it necessary to discuss each group separately, and then show the relation between them. The oral hygiene group will be discussed first, with a brief outline of the school system.

The oral hygiene group carries on all the dental educational work in the public and parochial graded schools in the city. The personnel is composed of five oral hygienists, working six hours a day, nine

*Dental Director.

months of the year. The hygienists work during the school year, and make their program conform to school hours. They begin their year September 15, and terminate it June 15, working from 8:30 a.m. to 3:30 p.m. five days of each week.

The total enrollment and number of schools 1932-1933 is as follows: public schools, 87, enrollment, 54,385; parochial schools, 83, enrollment, 30,564; total, 170; total enrollment, 84,949.

Each hygienist is equipped with a portable chair with detachable cuspidor, aseptic stand and complete set of prophylactic and examining instruments.

Owing to the fact that a great number of the schools of the city have an enrollment of more than 800 pupils, the five hygienists have been grouped into two teams of two each, the other hygienist working alone in the smaller schools.

The hygienists make their contacts at the school, and arrange a schedule of their activities with the principal. Whenever possible, the dental director makes the contacts for the hygienists. When the contemplated contact is made, the school nurse is notified in order that she may be ready to assist in any way possible in making the program a success.

With the entrance of the hygienists into the school, the portable equipment is set up in the nurses' room, or any other suitable room in the building having sufficient light and ventilation and with running water close at hand.

Each child in the kindergarten and the first four grades is given a dental examination and the findings are recorded on a permanent record card. This card is so designed as to serve through the complete graded school course. When the hygienist completes her visit, the card is filed in the physical record envelope in the school file. At subsequent visits, it is removed and new recordings are made. In this way, a dental record of each child up to the fifth grade is available at all times. All cases examined are classed according to severity with the following symbols: x, mild; xx, bad; xxx, very bad. Each child needing dental care is given an envelop containing a notice regarding defects, and a booklet about care of the teeth, to be taken home to the parents. The xxx, or very bad, cases are referred to the school nurse for follow-up work.

When the hygienists have completed their examinations, they begin their lecture work. Each class is given a separate lecture on toothbrush instruction, this being carried out in the classroom. Two or three classes are then grouped in the auditorium and a lecture with the aid of slides and movies is given on tooth development, diet and mouth cleanliness. Suitable posters and slogans are distributed in the school by the hygienist on entering, and on leaving, she gives one to the principal to be placed in the school in a conspicuous place.

When the examinations and classroom and auditorium lectures are finished, the hygienists begin a series of prophylactic treatments. These prophylactic treatments are given to all children in the second and third grades only. The program is so arranged that each school in the city will be visited at least once every year and a half. The prophylactic treatments are primarily given to teach mouth cleanliness, and if a school child receives one prophylacticc treatment in conjunction with a well-rounded program, it will help to impress on his mind the value of mouth cleanliness.

After the prophylactic treatments, and when completing the program in a school, the hygienists conduct a sale of toothbrushes. With the aid of the teachers and school nurses, the children are encouraged to purchase toothbrushes. This procedure has proved very satis-

factory, helping to impress on the children the need of brushing the teeth.

As the dental department is a branch of the health department, and not part of the school board, all the follow up work is done by the health department nurses, who see the children in the schools and make all the necessary home calls. At present, the nurses are only able to follow the very bad or xxx cases, owing to the great demand for their services. Up to three years ago, the parents of all children receiving defect notices were seen in the home and referred to either the family dentist or the health department clinics. All dental corrections, when completed, are entered by the nurses on the permanent dental record card. In this manner, the hygienists at their next visits have a record as to whether the children have obtained dental treatment.

The foregoing program is carried out in all the schools in the city of Milwaukee at present. In the school year ending June 21, 1934, 115 schools having a total enrollment of 54,725 pupils received a dental health educational program.

As an aid in determining the status of our community both financially and dentally, a standard of rating schools was adopted in September, 1933. The nurses working with the graded school principals rated each school on the following basis: schools having less than 25 per cent indigent children, good; schools having between 25 and 50 per cent, medium; schools having 50 per cent or over, poor. By using this standard of financial classification, we were able to obtain the number of dental defects in each particular class of schools. Following are statistics on 50,000 school children compiled to give the actual conditions of a number of schools picked at random from each class: thirty-five medium schools, 25 to 50 per cent indigents; 38 poor schools, 50 per cent or over indigents; 27 good schools, less than 25 per cent indigents; total, 100. Details are given in the accompanying table.

STATISTICS ON 50,000 SCHOOL CHILDREN

| | Good Per Cent | Medium Per Cent | Poor Per Cent | Average Per Cent |
|---|---|---|---|---|
| Abscess cases | 15 | 15 | 17 | 16 |
| Condition of first permanent molar: | | | | |
| Decayed | 39 | 46 | 48 | 44 |
| Missing | 3.3 | 4 | 7 | 5 |
| Cases free from dental caries | 9 | 8 | 8 | 8 |
| Oral cleanliness: | | | | |
| Good | 31 | 24 | 16 | 24 |
| Fair | 19 | 20 | 19 | 19 |
| Poor | 50 | 56 | 65 | 57 |
| Evidence of professional dental care received: | | | | |
| Adequate | 14 | 13 | 7 | 11 |
| Partial | 26 | 25 | 21 | 24 |
| None | 60 | 62 | 72 | 65 |

Owing to the fact that a great number of people have not been able to consult the private practitioner for dental service for their children, plus the crowded condition of our clinics, the percentage of corrections is low, and the percentage of infection and oral cleanliness high. The only way to face the problem of adequate or proper dental care for children, both rich and poor, is to know the true condition in your community or all communities.

The operative group functions in three dental clinics in the city. The personnel is composed of three full-time dental operators, one in each clinic, and two half-time operators working ten months of the year in two clinics with the full-time operators.

The following policy as regards entrance to the clinics for free dental care has been adopted: All children of indigent families are eligible for free dental care. The question of indigency is determined by the school nurse. When the parents present themselves for free dental care, the nurse is required to make out a social history which is a detailed account of the financial status of the family. She is assisted in this work by the various social agencies operating in our city. When the history is complete, it is compared with a budget sheet. This budget sheet, drawn up by the dietitians and social welfare agencies in our community, contains a detailed accounting of the cost of maintaining any family, regardless of its size. By comparison, it is determined whether the family is eligible for free dental care, and if it is, the nurse sends the children to the clinic.

The clinic procedure is as follows: All children under 12 years of age receive complete dental care, which consists of placing amalgam and "kryptex" fillings in deciduous and permanent teeth, prophylaxis, extractions and roentgen-ray work when necessary. Children over 12 years of age receive emergency work only. This consists of sedative treatments, extractions and an occasional filling, when the tooth being treated can be saved.

With the extensive program of dental education carried out in the schools, it is easy to understand the number of child patients streaming to the clinics. With the limited number of dental operators on our staff, it is only possible to scratch the surface in endeavoring to take care of all of them adequately. This being the case, we have stepped up the extraction service considerably the last two years, feeling that at least we are able to remove the badly infected and painful teeth causing the greatest damage.

Gas extraction clinics are held two and three mornings each week, depending on the number of cases on file, in two of the three health centers. At each clinic, eighteen children are appointed and receive the extraction service. Each child is given a physical checkup by one of the physicians on the staff before the general anesthetic is administered. This procedure has been followed for years and has proved very satisfactory.

In addition to the extractions under nitrous oxide-oxygen anesthesia, the doctors in each clinic perform a considerable amount of extraction work under local anesthesia. This is necessary for emergency cases.

The need for both dental educational work and actual restorative dentistry is very great today. The educational work, which is preventive dentistry in its highest form, cannot be stressed too greatly. The crying need for dentistry for the masses is becoming greater each day. We have tried to develop a program that will include all the essentials for a successful program, but will not interfere with private practitioners in their work.

## DENTAL EDUCATIONAL MODELS

The Bureau of Public Relations has secured a set of sixteen beautifully hand carved large wax models (page 1888) for your use. They are in natural colors and show in clear detail many normal and abnormal dental conditions.

The models are arranged in sets, each set telling its own story. Mounted in neat, black cases, these models come to you ready for showing at your community health meetings. They are excellent for P.T.A. meetings, civic clubs, schools, fairs and health centers.

Descriptions are as follows:

Model 1.—Profile of normal 6 year-old child.

Model 2.—Profile cut out of 6 year-old child, showing (*a*) deciduous teeth in place, (*b*) permanent teeth developing beneath deciduous teeth, (*c*) first permanent molars in place and (*d*) partially formed second permanent molars in jaws.

Model 3.—Profile of child sucking his thumb.

Model 4.—Profile of child showing protrusion of upper front teeth due to thumb sucking.

Model 5.—Profile cut out showing normal occlusion of adult.

Model 6.—Profile cut out demonstrating damage which frequently follows the loss of the first permanent molar: (*a*) shifting of adjacent teeth, (*b*) loss of contact, (*c*) decay, (*d*) pyorrhea pocket and (*e*) bone destruction.

Model 7.—Cut out side view of adult mouth showing (*a*) longitudinal sections of teeth, (*b*) decay, (*c*) abscess, (*d*) impacted lower third molar, (*e*) gingivitis, (*f*) mandibular canal—blood vessels and nerves and (*g*) maxillary sinus.

Model 8.—Longitudinal section of lower molar showing enamel, dentin, cementum, pulp, peridental membrane, bone, etc.

Model 9.—Life mask showing asymmetric development of face due to early loss of a first permanent molar.

Model 10.—Life mask showing a symmetrically developed face.

Models 11a and b.—Life mask showing the "close bite" produced by the early loss of all four permanent molars.

Models 12a and b.—Life mask showing face restored to normal by proper dental restorations.

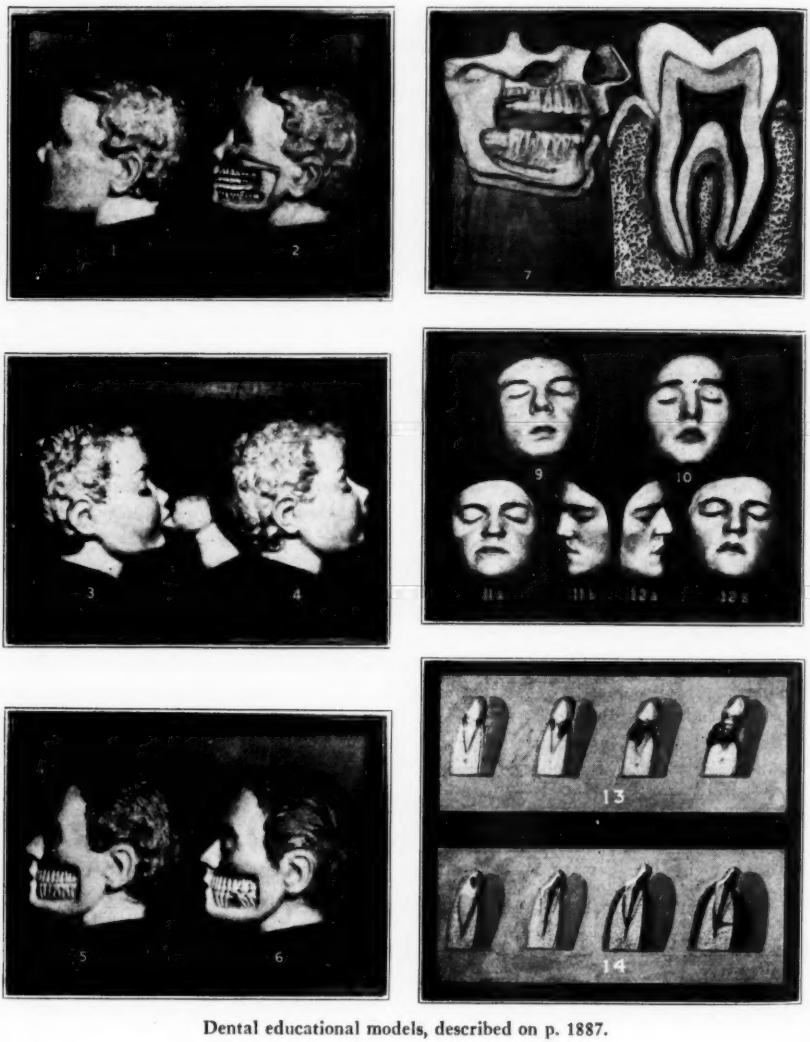
Models 13.—Four models demonstrating how the hard and soft tissues are injured by the accumulation of calculus.

Models 14.—Four models demonstrating the progress of decay from the initial attack on the enamel to the formation of an abscess at the root end.

You can rent the entire set of sixteen models for $5.

Models 1 to 6 inclusive rent for $2; models 7 to 12 inclusive, for $2; models 13 and 14, for $2. The renter pays the express charges to and from Chicago, Ill.

Write to the Bureau of Public Relations, American Dental Association, 212 E. Superior St., Chicago, Illinois, for reservations of these models.




Dental educational models, described on p. 1887.

# CURRENT LITERATURE

*Changing Concepts of Nutrition (J. C. McLester, J.A.M.A., Aug. 11, 1934):* The day was when physician advised what the patient must not eat; now he advises what the patient must eat. Until recently, nutrition was regarded as a stepchild of medicine in spite of illustrious investigators along the ways from Lavoisler to Lusk. This is attributed to the semicharlatanism that flourished in this field. The change is explained on the basis of the order of evolution in modern medicine, the order in which the basic sciences have developed, cellular pathology coming early and present day physiology late. Formerly, food was thought of in terms of local pathologic conditions; it is now thought of in terms of general physiology.

*Intensive Liver Extract Therapy of Sprue (C. P. Rhoads and D. K. Miller, J.A.M.A., Aug. 11, 1934):* Prior to 1927, the treatment of sprue was almost entirely dietary. The policy was to restrict the intake of fat and carbohydrate and to depend on different single apparently dissimilar foods as the sources of nutrition. Complete cure occasionally followed, but a stage of the disease was more often attained in which dietary measures were ineffective. A few case histories are given, with glossitis, stomatitis, diarrhea and loss of weight in varying degrees. Four cases refractory to ordinarily effective treatment were cured by intensive parenteral liver extract therapy. It is concluded that the use of liver extract in sprue is indicated by the etiologic mechanism of sprue; sprue frequently requires more intensive treatment with liver extract than does pernicious anemia, and the use of large amounts of liver extract is the therapeutic procedure of choice in sprue.

*Medical Ethics and New Methods of Practice:* Conceivably, there are situations in which the practice of medicine under a contract may be necessary or desirable. In order to elucidate this phase of medical practice, the Principles of Medical Ethics, chapter II, article V, section 2, is now amended by addition of the following wording: By the term "contract practice" as applied to medicine is meant the carrying out of an agreement between a physician or a group of physicians, as principals or agents, and a corporation, organization or individual, to furnish partial or full medical services to a group or class of individuals for a definite sum or a fixed rate per capita. Contract practice per se is not unethical. However, certain features or conditions if present make a contract unethical, among which are: 1. When there is solicitation of patients, directly or indirectly. 2. When there is underbidding to secure the contract. 3. When the compensation is inadequate to assure good medical service. 4. When there is interference with reasonable competition in a community. 5. When free choice of a physician is prevented. 6. When the conditions of employment make it impossible to render adequate service to the patients. 7. When the contract because of any of its provisions or practical results is contrary to sound public policy. Each contract should be considered on its own merits and in the light of surrounding conditions. Judgment should not be obscured by immediate, temporary or local results. The decision as to its ethical or unethical nature must be based on the ultimate effect for good or ill on the people as a whole. . . . The ethical principles actuating and governing a group or clinic are exactly the same as those applicable to the individual. As a group or clinic is composed of individual doctors, each of whom, whether employer, employee or partner, is subject to the principles of ethics herein elaborated, the uniting into a business or professional organization does not relieve

them either individually or as a group from the obligation they assume when entering the profession. . . . It is unprofessional for a physician to dispose of his professional attainments or services to any lay body, organization, group or individual, by whatever name called, or however organized, under terms or conditions which permit a direct profit from the fees, salary or compensation received to accrue to the lay body or individual employing him. Such a procedure is beneath the dignity of professional practice, is unfair competition with the profession at large, is harmful alike to the profession of medicine and the welfare of the people, and is against sound public policy.—Editorial, *J.A.M.A.*, July 28, 1934.

*Agranulocytic Angina Following Ingestion of Dinitrophenol (S. S. Bohn, J.A.M.A., July 28, 1934):* The author makes reference to the use of the barbiturates and amidopyrine as possible causes of leukopenia. In these reports, mention was made of a case resulting from the use of dinitrophenol. No amounts of the drug taken nor accounts of the blood picture were given; hence, Bohn reports a case. Agranulocytic angina developed after the ingestion of 21.8 gm. of 2.4 dinitrophenol sodium over a period of four months. The dosage was 4 mg. per kilogram of body weight daily for two weeks and then double the amount until the onset of unfavorable reactions. The treatment consisted of discontinuing the drug, administering pentnucleotide and given a transfusion of 250 c.c. of whole blood, after which the patient recovered. A table and graph complete the history.

*Agranulocytic Leukopenia—a Report of Case Successfully Treated with X-Rays (J. E. Benjamin and J. E. Biederman, J.A.M.A., July 21, 1934):* Granulopenia was due in the case reported to drug hypersensitivity, the hematopoietic system acting as the shock organ. The disease was apparently amendable to high voltage roentgenotherapy.

*Vitamin C Potency of Spinach Under Varying Conditions (Edith Pierson, South Dakota Agr. Exper. Stat., 1934, p. 16):* The determination of vitamin C by the Hojer method cannot be recommended because of the difficulty of securing satisfactory tooth sections. Commercially canned spinach, Spinacia oleracea, contains insufficient amounts of vitamin C fully to protect guinea-pigs from scurvy when fed at the 15 gm. level. Boiling for three minutes or allowing the opened can to stand for twenty-four hours before feeding did not significantly affect the vitamin C content. Fresh or canned New Zealand spinach gave but little protection from scurvy.—Abstr. *Am. J. Dis. Child.*, August, 1934.

## Foreign Literature

*Sodium Citrate as a Hemostatic (J. B. Hutchison, Glasgow M. J., May 1934):* Hutchison observed three patients in whom postoperative oozing of blood continued in spite of the administration of the usual hemostatics. In each of the cases, bleeding ceased immediately after the intramuscular injection of 30 c.c. of a 30 per cent solution of sodium citrate. The effect of sodium citrate seems to be transitory. Its effect is noticed within a few minutes and is most marked in forty-five minutes, when the coagulation time is found to have diminished from the normal, seven or ten minutes, to about two minutes. It remains at this level for two or three hours and gradually returns to its original time.—Abstr. *J.A.M.A.*, July 21, 1934.

*"Blood Group Ferment" and Blood Group Substance in Saliva (T. Satoh, Wein. Klin. Wchnschr.):* Satoh calls attention to the fact that in the feces and in the saliva processes take place that become manifest in a destruction of the blood group substance. These processes have been ascribed to the presence of the so-called blood group ferment. The author made further studies on the saliva, first on that of the A group, and found that irrigation of the mouth results in only a slight reduction of the blood group A substance and in an almost complete disappearance of the ferment action. Tests were made also on the saliva of the O group and it was observed that the group ferment directed

against substance A is again largely removed by irrigation of the oral cavity, even though its disappearance is not quite so pronounced as in the saliva of the A group. These and other experiments seem to prove that the blood group substance rapidly reappears in the saliva or hardly disappears. The blood group ferment, however, is subject to great fluctuations and can be removed almost completely by simple irrigation of the oral cavity. The author thinks that these observations indicate that the blood group ferment in contradistinction to the blood group substance develops or increases autochthonously in the oral cavity. —*J.A.M.A.*, July 28, 1934.

*Have We Found the Ideal Root Filling Material? (Harold Nordgaard, Norske Tannlaegefor. Tid., April, 1934):* The author discusses the different new methods in use in root canal therapy, stressing the radio-active root filling material radiolix as the type of material approaching the ideal. It is harmless and easy to handle. Its antiseptic action is absolutely permanent, being due to its radio-activity, which also markedly increases the regenerative powers of the periapical area. The author has used the material for three years with marked success and gives experimental data and case histories with roentgenograms to prove his point.

*Capillary Microscopic Examinations as a Means of Diagnosis in Marginal Paradentitis (Åke Wikblad, Tandlaegebladet, May, 1934):* In his very interesting article, the author discusses the development and present status of capillary microscopy and its use in dentistry in connection with the diagnosis of paradentitis. While the method is not fully developed for general use as yet, it seems to promise something very definite: it will exclude the case of paradentitis due to general metabolic changes from the cases of local, oral origin. Further, it seems to promise a great deal in connection with paradentitis prophylaxis as slight capillary disturbances are visible in the gingiva of the susceptible child. With thorough cooperation from the pediatrician and internist, such a child should be managed with the hope of normalizing the metabolic processes, thus preventing not only the local nutritional disturbances, called paradentitis, but other general disturbances, particularly of the vasoneurotic type.

*Tests for Motor Disturbances of the Soft Palate (Béla Freystadtl, Wein. Klin. Wchnschr., Feb. 28, 1934):* In complete peripheral paralysis, the soft palate does not move voluntarily or involuntarily. Voluntary motion can be tested by asking the patient to say "Ah" and watching to see whether the soft palate rises well or only slightly. In pyramidal paralysis, voluntary function is paralyzed as in phonation, whereas involuntary function continues. Involuntary motion may be tested by observing reflex swallowing movements. Touching the center of the posterior pharyngeal wall usually causes contraction of the muscles of the soft palate. When persons are insensitive to this test, the epiglottis may be touched, for with the adduction of the vocal cords, there also sets in contraction of the velum. In lesions of the extrapyramidal tract, both voluntary and involuntary movements can be carried out, but speech becomes nasal. With paralysis of the soft palate it becomes practically impossible to puff out his cheeks. The lesion is either of the peripheral nerves or of the pyramidal tract. In these cases closing the nose will enable the patient to carry out this movement, but when the nose is released the air rushes out and the cheeks become flattened. Puffing out of the cheeks tests also the functional integrity of the orbicularis oris muscle.—Abstr. *Am. J. Dis. Child.*, August, 1934.

*First, or Deciduous, Dentition (Cenek Saitz, Zubni lék., February, 1932):* The author reviews the history of dentition from the time of the ancient Chinese and gives citations from the literature from the time of Hippocrates. It is interesting to note that even in those early times there was knowledge of the prenatal influence on the primary dentition as well as an orderly description of the various ailments attributable to teeth even in the present day.

The consensus is that teething is physiologic and that the diseases found during this period are not attributable to teething *per se*. It is surprising that the insignificant tooth should warrant such a mass of literature over a period of twenty-three centuries.—Abstr. *Am. J. Dis. Child.*, August, 1934.

*Are Granulomas Regularly Infected? (B. Mela, Zahnarztl. Rund., Vol. 43, 1934):* While Appleton, Bulleid, Hartzel, Henrici, Weber, Pesch and others claim that all granulomas are infected, many others, such as Harndt, Löffler Kuhn and Von der Osten-Sacken, have found a great percentage of granulomas to be sterile. This difference in opinion is due to the various technics and also due to the great difficulties in studying this problem. That work must be done absolutely by bacteriologic methods, since histologic research of this problem is of no value. A knowledge of the bacterial flora of granuloma and its properties is of great practical importance, since it is said that, primarily, their influence in the formation and persistence of the granuloma is not clear, and, secondarily, according to the focal infection theory, the bacterium of a granuloma may penetrate the local protective wall and spread farther in the organism, thus causing disease at distant points.

The author investigated the microbal contents of fifty apical granulomas that were intact with the root apex after extraction. The first twenty-five granulomas were quickly immersed in alcohol and then passed over a flame; the last twenty-five were, according to the technic of Von der Osten-Sacken, at first immersed in a tubule containing a prodigiosus-bullion culture, then a red hot instrument was passed tangentially over the upper surface. Of these fifty granulomas, nine were sterile, three from the first twenty-five and six from the last twenty-five cases. The microbal contents of fifteen granulomas were then directly injected in the blood circulation of guinea-pigs. In five cases, the bacteria were found in the blood twenty-four hours after the injection. In six cases, the bacteria were found in both the blood and the organs. In no cases were the bacteria observed in a single organ only.

*Healing Processes After Root Perforation (A. Kübler and Wildboerg, Schweiz. Monatschr. f. Zahnheilk, Vol. 44, 1934):* The author describes a great number of experiments, on both animals and human beings, and, from a clinical practical observation, he comes to the following conclusions: 1. The dentist can avoid root perforation only by knowing thoroughly the anatomy of root canals and by a thorough understanding of root-canal therapy. If a root is perforated in spite of that knowledge, the dentist must recognize that fact immediately. An accurate diagnosis should be made as to whether the perforated root can be successfully treated. 2. The authors' results are based on perforations which occurred under aseptic and antiseptic conditions. The prognosis in perforation of roots under septic or gangrenous conditions is always unfavorable, always resulting in abscess formation, acute or chronic pus flow with fistula formation and eventually the loss of the tooth. The prognosis in perforation of the root in the presence of healthy dentin and cementum is most favorable. 3. Regarding choice of materials, the author gives the following: Group I. Solid materials, such as gold (cast), amalgam or porcelain for perforations near gingival line or gingival crevice. Soft-remaining pastes became quickly resorbed and permit communication between the gingival crevice and root canal. The material selected was the same as that for filling the cavity, the cavity being extended to perforation. In all these cases, there occurred a proliferation of the gingival epithelium covering the perforation and the gingival crevice was deepened. As a result, the normal state is not reached, but function of the tooth is assured. For deeper perforations, or those close to the apex, solid materials cannot be used. Group II. Resorptive materials (Walkhoff paste-iodoform cement) for perforations not in the gingival space. The Walkhoff paste prevented infection and resulted in sufficient healing to assure

operation of all functions necessary for the tooth. When inflammatory processes occurred, they never reached a degenerative stage. Through the inability of a rapid ingress of gum epithelium, the proliferating periodontal structure encapsulated the perforation and enabled the formation of secondary cementum as a substitute for the resorbed dentin, and cementum. There, where no cementum formation occurred, one can count on the resorption of the iodoform paste by the ingressing periodontal structure. Technically, this method is very simple, since together with the closing up of the perforation, the root canal can be filled.

*Orthodontic Therapy (G. L. Liger, Rev. Odontol., May, 1934):* It is essential to establish the etiology before attempting treatment to correct an anomaly. The age of the child is an important factor to be considered. The temperament of the child should also be studied. It is a mistake to believe that orthodontia consists merely in placing apparatus in a child's mouth to correct deformities. Many failures may be explained by the fact that the practitioner failed to supplement the mechanical action of the apparatus with other methods. Medical therapy may be preventive by developing the subject hygienically (air, light, sun, exercises, etc.) and giving him the correct diet. It may also be curative, treating rickets and its consequences. Surgical therapy is essential, removing or preventing deformities. Prosthetic therapy makes use of apparatus, keeping the face in shape while awaiting the development of permanent teeth or reestablishing contacts. Physiologic therapy stimulates natural forces. Mechanical therapy is the most generally used. There are two limiting factors, tissue reactions and applied force. The author discusses these therapeutic methods fully and urges that their combined use is essential for success in orthodontic therapy.

*Pemphigus of the Buccal Mucosa (Adolph Acevedo, Rev. Odontol., May, 1933):* The author says that oral manifestations of pemphigus precede cutaneous lesions from twenty days to a year. The fact that oral lesions are seen in the initial stage of the disease is a proof that the general condition of the patient is good. In the beginning, the patient feels a dryness and burning in the mouth. Mastication and swallowing are painful. Saliva runs freely. There are characteristic bullae containing a clear fluid. The bullae break easily and leave diffuse erosions which are covered by membranes with a white or bluish gray exudate. These membranes tear off easily and cause a bleeding, painful wound. The lesions occur on all parts of the buccal mucosa. The author concludes that since pemphigus frequently begins in the mouth, the dentist is the first to see it. He should send the patient to a specialist immediately. By taking the disease in its earliest stages, the promise of successful therapy is greater. —Abstr. *Rev. Odontol.*, May, 1934.

*Focal Infection, with Particular Reference to Elective Localization of Streptococci (B. Mela, Stomatologia, June, 1934):* In his second paper on focal infection, the author has studied elective localization with fifty-two strains of streptococci. Of these, thirty-seven came from oral foci in patients with nephritis or chronic arthritis or without other clinical manifestations. The remaining fifteen strains came from surgically removed gastroduodenal ulcers. From these researches, the author asserts that by following the technic suggested by Rosenow, a general infection can be provoked in the infected animals. The germs spread throughout the tissues as shown by bacteriologic and histologic researches. It is certain that streptococcic strains will cause lesions more frequently in certain tissues (joints) than in others. Moreover, strains isolated from oral foci in persons with nephritis or arthritis will produce more evident lesions in kidneys and joints, respectively, than in other organs in a larger number of cases than the strains isolated from healthy persons or from those with other diseases.

*Hemophilia and Hemogenia (Bertrand-Fontaine, Rev. Odontol., June, 1934):* The author characterizes and differentiates between hemophilia and hemogenia both of

which are hemorrhagic syndromes. Hemophilia is a familial and hereditary disease. It occurs chiefly in men, but it is transmitted by women. People with hemophilia rarely live beyond the ages of 25 or 30. The hemorrhages must be provoked by some accident or surgical measure. There are characteristic lesions in the knees, hemarthroses. Hemophilic sufferers are subject to attacks of hemorrhages. Recent therapeutic measures have given a more favorable prognosis to the disease. The chief symptom of the disease is delay in coagulation time of the blood. Hemogenia is essentially a disease of the blood vessels. Another name for the disease is chronic purpura. The hemorrhages are spontaneous. It occurs chiefly in women and it is not familial. The disease does not usually appear until after puberty. It is chronic. There are three good tests for these diseases: (1) coagulation time, (2) the bandage sign and (3) determination of the number of blood platelets. In conclusion, the author reviews the various methods of therapy for these hemorrhagic syndromes.

*Development of the Dental System, with Pathologic Deductions (C. Ruppe, Rev. Franc. de Puéricul., April, 1934):* This article contains a summary of the embryology and development of the dental system with pathologic deductions. After stating that man possesses two dentitions and enumerating the teeth in each dentition, the author says that all these teeth develop in the same way. He divides the development into three periods. In the first period, the epithelial and connective tissues become specialized. This is called the period of cellular differentiation. In the second period, the germ is calcified. He calls this the period of differentiation of fundamental substance. The crown is formed. In the third period, the tooth forms its roots and erupts. The author discusses at length each of these periods from the normal and pathologic points of view. He shows the dystrophies and infections which may influence the tooth in the first period, causing anomalies in the number, size and shape of the teeth. In the second period, the pathology of the teeth is chiefly to be found in the enamel (erosions, spots, Hutchinson's teeth, etc.). In the third period, the disturbances may be in the time or order of eruption. They may cause faulty dentition or there may be an absence of eruption. The temporary teeth rarely present anomalies, but the permanent teeth show frequent dystrophies. According to the tooth or teeth affected, one may determine the period when the damage was done. The practitioner should always search for congenital syphilis.

*Dental Cements (Sidney Holt, Brit. D. J., July 16, 1934):* In May, 1933, the Dental Investigation Committee of the Department of Scientific and Industrial Research, following the suggestions made to them by the Dental Board of the United Kingdom, initiated an investigation on dental cements and lutes,, having as its ultimate object the production of a translucent adhesive material capable of being used as a cement for inlays and crowns. It was also considered desirable that this material should, if possible, be used as a filling material. As this work has now been terminated, it was agreed that an account of the preliminary inquiry would be of interest to members of the dental profession. [Ed.—An abstract of this article would be difficult and unsatisfactory, but the article is recommended to those interested in cements.]

*Occupational Diseases of Dentists (J. Lowy, Med. Klin., May 4, 1934):* Lowy classifies the occupational diseases of dentists into three groups: (1) those caused by unsuitable posture during work, (2) infectious diseases and (3) poisonings. Whether the frequent neurasthenia is a disease *sui generis,* he is unable to decide, but he thinks that it may be due to prolonged confinement in closed rooms. In discussing the disorders caused by unsuitable posture, he mentions first the thoracic changes, which in turn may lead to cardiac and circulatory disorders. Prolonged standing may lead to the development of flatfoot and varicose veins. Removal of tartar from the teeth involves the danger of corneal injuries, and handling of plaster of Paris may lead to the formation of rhagades. The infectious diseases that threaten the dentist are par-

ticularly those of the upper respiratory tract, such as diphtheria, catarrhs, influenza, tonsillitis, measles, scarlet fever and tuberculosis. There is also a certain danger of an extragenital syphilitic infection. The frequent use of the roentgen apparatus likewise involves dangers. The use of certain chemicals may lead to eczema. One of the greatest dangers is chronic poisoning by mercury. The author thinks that nervousness, which occurs rather frequently in dentists, is often the result of chronic poisoning. Dentistry as a profession is inadvisable unless the person has a normal nervous system and an intact respiratory apparatus; the nasal breathing, particularly, should be free. There should be no predisposition to curvature of the spine or to the development of flatfoot and varicose veins.—Abstr. *J.A.M.A.*, June 30, 1934.

*Dentistry in India: To the Editor of the British Dental Journal:* With reference to the note "Dentistry in India," in the *British Dental Journal,* of May 15, 1934, it may interest your readers to know that India is greatly handicapped in the matter of dental education. There is, at the present moment, not a single Government dental school in the whole of India. The Calcutta Dental College and Hospital, founded in 1920 by private initiative and effort, is the only school which offers a systematic course in dental surgery. The course offered there is, as you have mentioned, one of three years after matriculation from an Indian university. For your information I am enclosing a prospectus which gives complete details of the course of study. You have rightly said that there should be no insuperable difficulty in adopting a standard that would satisfactorily correspond with the requirements in other parts of the Empire. The authorities of the Calcutta Dental College are sparing no pains to bring the curriculum and course of study on a par with that of the General Medical Council of the United Kingdom. The greatest obstacle in doing this is that owing to the absence of any dental registration law anyone may practice dentistry in India, and consequently there is no incentive for taking a complete dental course. Many students put in one or two years and as soon as they think that they have got a smattering knowledge of dentistry they leave the dental school and start in practice. There is no way to stop this. The attention of the Government has been drawn to this matter, but they are of the opinion that the time has not yet arrived for a dental registration law. Recently, owing to the influx of a large number of quack Chinese and Japanese dentists, public meetings protesting against this have drawn the attention of the Government of Bengal to this matter, but nothing so far has been done. Therefore, it can be seen how proper dental education is being handicapped. Apart from this, none of the provincial medical registration boards—not to speak of the Universities—have set up any standard of dental education that may be followed. To put the dental house in order in India, it would first of all be necessary to set up a State Dental Faculty, who would be authorized to set up a standard dental course of studies, and secondly to have a dental registration law for each province. Unless this is done no progress is possible. India seems to be the Cinderella in the dental world. With these facts in mind your readers may possibly sympathize with the lone fight we are putting up, and the uphill path we have before. Yours faithfully, R. Ahmed, Principal, The Calcutta Dental College and Hospital.—*Brit. D. J.*, July 16, 1934.

# NEWS

## ARKANSAS

*Dr. Talbot Addresses Physicians:* The Tri-County Clinical Society (Medical) was addressed in Hope, recently, by Forno M. Talbot, D.D.S., on "Dietary Deficiencies as Related to Dental Diseases."

*Southeast District Reorganizes:* The Southeast District, which has been inactive for two or three years, reorganized at the state meeting in May and expects to have an active society by the time of the 1935 state meeting. H. S. Neel, of Stuttgart, is the new president.

## CALIFORNIA

*Drs. Kier and Kyes on Magazine:* Appointment of Edward Kier and Frank Kyes to represent San Diego County on the staff of the *Pacific Coast Dental Conference Magazine* was made recently.

*Dr. Lockwood Commissioned:* A. T. Lockwood, Fresno, was commissioned first lieutenant in the United States Army Reserve Corps recently.

## DISTRICT OF COLUMBIA

*Health Council Established:* The District of Columbia Health and Hospital Council, composed of representatives of medical, dental and civic societies, was recently formed under the sponsorship of the Council of Social Agencies. The council will be available to all government authority as a medium of ascertaining the opinion and reaction of the majority in professional, administrative and lay organizations representing the citizens in the district, according to a statement issued by Ross Garrett, health secretary of the Council of Social Agencies. The dentists named on the committee are: C. Willard Camalier, G. Albert Smith and Webb W. Wyman.

## INDIANA

*The Credit Department:* Since the establishment of the Medical and Dental Business Bureau, Indianapolis, March 1, 6,602 accounts for collection have been referred by 156 physicians, and 1,251 accounts by sixty-six dentists. The bureau is now serving in delinquent collections a total of 222 physicians and dentists on 7,853 accounts. A total of $4,767.80 has been collected from March 1 to July 21. About 400 of the accounts filed for collection owe from two to eight physicians and dentists each. The bureau was established for members of the medical and dental societies of Indianapolis.—*J.A.M.A.*, Aug. 18, 1934.

## IOWA

*Better Children's Dentistry for Iowa:* For the past two years the Oral Hygiene Committee composed of Drs. Hildebrand, Henshaw and Drain have labored with an idea of bringing about an improvement in children's dentistry throughout the state. After careful consideration, it was decided to organize lecture-clinic groups consisting of five men in each of the ten districts of the state society. These groups have been formed by the oral hygiene committee and have been furnished with material in order that the lectures and clinics given might be standardized. It has been so planned that no dentist in the state need travel more than 50 miles to attend one of these meetings.

*Iowa's Membership Largest in History:* August 1, the Iowa State Dental Society enjoyed the largest membership in its history with 1,080 members in good standing. With returns following the St. Paul meeting, the membership is expected to reach 1,100.

## KANSAS

*The Tri-State Meeting:* At the recent Kansas, Missouri, and Oklahoma Tri-State Dental Meeting held in Kansas City there were more than 2,000 in attendance.

*Burket Clinic Trophy:* The following rules and regulations for the awarding of this trophy have been approved by the Executive Council, 1932. Name: Burket Clinic Trophy. Judges: One each to be selected by the president, president-elect, and secretary of the Kansas State Dental Association, their identity to remain unknown to anyone. To whom awarded: The clinician receiving the highest average, graded on the following: (1) 40 per cent, value of clinic to advancement of dentistry; (2) 10 per cent, originality; (3) 10 per cent, presentation; (4) 15 per cent, practicability; (5) 10 per cent, simplicity; (6) 5 per cent, punctuality; (7) 10 per cent, neatness. Eligibility: Membership in Kansas State Dental Association. Permanent possession: Only in event it is won three times by same clinician, and no winning clinic to be repeated another year. The first five men winning highest average grades on their clinics at the state meeting are honored by being chosen to represent their state at the next annual meeting of the American Dental Association, and the next five serve as alternates. The names of all ten men are read before the society according to their ranking.

**MASSACHUSETTS**

*Death of Dr. Mitchell:* George Everett Mitchell, for twenty-seven years a member of the Massachusetts Board of Registration in Dentistry and organizer with the late Dr. John F. Dowsley of Boston of the New England Association of Dental Examiners, died August 23, at his home in Haverhill, at the age of 81. He studied dentistry with the late Dr. J. W. Bell of Boston and was graduated from Boston Dental College, now Tufts Dental College, in 1874. Dr. Mitchell was a former president of the National Association of Dental Examiners and of the Haverhill Dental Society and a member of the Rhode Island State Dental Society. He had contributed liberally to dental literature and studies in dental legislation.

**MICHIGAN**

*Dr. Warnshuis Goes to California:* Frederick C. Warnshuis, Grand Rapids, for many years speaker of the House of Delegates of the American Medical Association and secretary of the Michigan State Medical Society, will go to California, October 1, to become secretary and director of public relations of the California State Medical Association. Dr. Warnshius was the guest speaker of the American Dental Association at the St. Paul meeting last August.

**NEW YORK**

*Dr. Burkhart Wins Honor in Dentistry:* Recognition as an international leader in dental health work has been given to Harvey J. Burkhart, director of the Rochester Dental Dispensary. Dr. Burkhart received notification of the award of the Jessen Prize of the International Dental Federation from J. S. Bruske, of Amsterdam, Holland, president of the executive council of the federation, August 15. The prize was instituted several years ago, in honor of Ernst Jessen, pioneer in children's dental health work.

**OHIO**

*Dr. Sargeant President:* Walter S. Sargeant is the newly elected president of the Northern Ohio Dental Association.

**PENNSYLVANIA**

*Dr. Van Kirk Addresses Physicians:* Laurence E. Van Kirk, of Pittsburgh, addressed a meeting of physicians under the auspices of the Clearfield Medical Society.

**TENNESSEE**

*Health Exhibit at Fair:* A health and medical exhibit was presented at the Mid-South Fair in Memphis, held September 3-8, under the auspices of the Memphis and Shelby County Medical Society. The medical, dental, pharmaceutic and nursing departments of the University of Tennessee exhibited.

**TEXAS**

*Honor Degree to Dr. Scherer:* Walter H. Scherer, of Houston, was elected recently to fellowship in the American College of Dentists.

**WASHINGTON**

*Society Activities:* Burley Mann, of Spokane, president of the Washington State Dental Association, is busy throughout the state instructing committees, counseling component societies and getting the legislative program under way. C. T. Fleetwood, of Seattle, is launching the public relations activity.

*Death of Dr. Tenny:* Cecil Lorenzo Tenny, of Seattle, a graduate of the University of Maryland Dental School, Baltimore, in the class of 1901, was killed in an automobile accident, June 19; aged 54. Dr. Tenny was a member of the Seattle District Dental Society, Masonic Order, Delta Sigma Fraternity and various local organizations. He is survived by the widow, two sons and two daughters.

**WEST VIRGINIA**

*New Members of State Dental Board:* J. H. Mayo of Buckhannon, was elected president of the West Virginia State Dental Board, and H. C. Hill, Charleston, was elected secretary-treasurer. The other members of the board are: H. A. Erwin, Hurricane, Nathaniel Barnard, Morgantown, and D. L. Grimm, Parkersburg.

DEATHS

*Bell, Stanley C.,* Grand Island, Nebr.; University of Illinois, College of Dentistry, 1918; died, July 8; aged 39.

*Fenton, Clyde L.,* Terre Haute, Ind.; Indiana University Dental School, 1921; died, August 6.

*Giles, P. O.,* Chicago, Ill.; Northwestern University Dental School, 1905; died, August 18; aged 62.

*Penhale, Russell,* Chicago, Ill.; killed in an automobile accident recently; aged 30.

*Reise, LeRoy,* Massena, Iowa; University of Iowa, College of Dentistry, 1931; died, June 2; aged 25.

*Roussin, Raymond Robert,* Detroit, Mich.; University of Michigan, College of Dentistry, 1918; died, May 15; aged 39.

*Sims, Nelson I.,* Kalamazoo, Mich.; Northwestern University School of Dentistry, 1895; died, July 3; aged 70.

*Willey, Harry D.,* Oakland, Calif.; University of Iowa, College of Dentistry, died, June 11.

## MISCELLANY

### BOOK REVIEWS

*Text Book of Histology.* By Alexander A. Maximow, late professor of anatomy, University of Chicago, and William Bloom, asssociate professor of anatomy, University of Chicago. Second Edition, completely revised. Price, $7, cloth. Publisher, W. B. Saunders Company, Philadelphia, Pa.

Publication of the second edition of this book was largely due to the complaint of teachers that the first edition was too large for beginning students of the subject. In result, the recast is almost equivalent to a new text. Dr. Maximow's fame in this field precludes need of any comment on the character of the subject matter. Many of the drawings are the work of this great master's own hands. Dr. Bloom had had long association with Dr. Maximow and knew his plans better than any one else, and hence was best fitted for carrying out the original purpose. The parts of the subject the author had not covered at the time of his death have been written or completed by scholars in the different phases of the work. The second edition still stands a colossal work, presenting as nearly as possible the last word of a living subject to date.

*Green's Manual of Pathology.* Fifteenth edition, revised and enlarged. By H. W. C. Vines, pathologist to Charing Cross Hospital. American Edition, edited by Kenneth M. Lynch, professor of pathology, Medical College of the State of South Carolina. Published by William Wood Company, 1934. Price, $6.50.

*Dental Histology and Embryology.* By Theodore B. Beust, M.D., D.D.S., professor of dental histology and comparative

anatomy, School of Dentistry, University of Louisville. Published by W. B. Saunders Company, Philadelphia. Price, $3.

This text comprises 158 pages, seventeen of which are devoted to cuts. The illustrations total 147, many of them requiring a half page or more. This suggests the total amount of printed matter. The author states his intent to correlate adequately the microscopic anatomy of the hard tissues with the biologic questions that arise in student minds. The chapter heads follow the customary pattern with the exception of the inclusion of "Posteruptive Changes in Enamel." Another feature is the chapter devoted to applied histology of enamel or operative dentistry. Beust gives as justification of another book on the subject "an intimate experience with teeth and tooth sections extending over a period of three decades."

*Principles and Technics of Full Denture Construction.* By Frederick W. Frahm, B.S., D.D.S., formerly professor of prosthesis, College of Dentistry, University of Southern California. Published by the Dental Items of Interest Publishing Co., Inc., Brooklyn, N. Y.

This book contains 583 pages, thirty-one chapters and 352 illustrations. The cuts are unusually good and their abundance and sequence reduces markedly the need of reading. It would be difficult to imagine a phase of full denture construction not discussed by the author. And the discussion is readable and clear. The book is intended to be of service to both student and practitioner. For the former, it would appear to be excellent; for the latter, it is redundant both as to illustration and description, a phase of professional bookmaking that perhaps cannot be helped. With the practice in teaching veering from textbook usage to lecture demonstration and reference, such a book appears as a worthy if not remunerative collation of technic for the library shelf.

*Dentistry—Its Professional Opportunities.* By Chase Going Woodhouse and Ruth Yeomans Schiffman, of the Institute of Women's Professional Relations. Published by the Women's College of the University of North Carolina, Greensboro, N. C., 1934. Price, $1.

In this bulletin, the first to be published of a series of studies each of which will discuss in detail some business or profession as an occupation for women, dentistry as a profession is adequately described, particularly as it relates to women. The general information regarding dentistry as a career is more comprehensive than has previously been assembled in one volume. Such topics as the number of dentists and the ratio to population, dental education and schools, necessary qualifications and prospective earnings are touched on. A chapter is devoted to the dental hygienist. Her field of work, opportunities and necessary training are well presented. Brief explanation is also made of the duties of the dental assistant and the dental mechanic. The book discusses logically the opportunities for women in dentistry and shoud be particularly helpful to vocational advisers, teachers and students who are considering dentistry as a profession.

JOSEPHINE P. HUNT.

*Taschenbuch der Klinischen Prothetik (Manual of Clinical Prosthetic Dentistry).* By Prof. Dr. H. Türkheim, Dental Institute of the University of Hamburg, Germany. Berlin: Hermann Meusser, 1933; 237 pages; 232 illustrations. Price, R. M. 11.80.

A very successful attempt to get away from the usual voluminous textbook on prosthetic dentistry, this small and handy manual covers the ground of full and partial denture, crown and bridge technic. The illustrations are excellent. Some of them are original, and some are reproductions from leading European and American publications (Schröder, Kantorowicz, Spreng, Kennedy). The author has had extensive experience in teaching; which explains the emphasis given to the enumeration and discussion of all mistakes, difficulties and fallacies that can occur in connection with the various procedures and technics. This manual of Türkheim gives a very good idea of the modern methods used in the teaching and practice of prosthetic dentistry in Germany.

RUDOLF KRONFELD.

## DEFINITION OF A REPUTABLE DENTAL COLLEGE

By virtue of the authority vested in it by Section 1321, General Code of Ohio, the Ohio State Dental Board hereby defines a reputable dental school as being one which requires as a minimum course of study leading to graduation, two years of predental study and the successful completion of a full four year course in professional dentistry, under the direct supervision of the dental faculty of a dental college in the United States of America.

The two years of predental study shall be obtained in an accredited college of liberal arts or an accredited college of a similar nature and must include English, 6 semester hours, physics, 6 semester hours, animal biology, 6 semester hours, and chemistry, 12 semester hours. The four years of dental study shall be obtained in a college of dentistry whose entrance requirements are in accord with the above described two years of predental study, and shall comprise four full school years of dental study in such dental college under the direct supervision of a dental faculty. Credit for not more than one year in the dental college may be granted to those having graduated in an accredited medical college.

The Ohio State Dental Board reserves the right to interpret the requirements for predental and dental courses of study.

The following resolution has been passed by the Ohio State Dental Board:

*Resolved,* that the Ohio State Dental Board will not admit to examination any applicant who has graduated from a dental school of a lower standard of both predental and dental education than that as defined by the Ohio State Dental Board, July 28, 1934; excepting those persons who have at the time of the passage of this definition and adoption of this resolution matriculated in the predental course of the professional school which has heretofore been defined by this board as a reputable dental school under date of June 27, 1931. Be it further

*Resolved,* that this definition and resolution shall in no way affect dentists who have practiced in a state or district of the United States prior to June 27, 1931 and/or matriculated in a professional dental school in the United States prior to June 27, 1931. Be it further

*Resolved,* that the secretary of this board shall immediately send by registered mail an authenticated copy of this definition and resolution to the deans of all the dental schools in the United States and Canada.

(Signed)

S. F. RIDINGS, D.D.S., *President,*
MORTON H. JONES, D.D.S., *Secretary,*
H. C. JARVIS, D.D.S.,
A. T. WILEY, D.D.S.,
H. VAN VALKENBURG, D.D.S.

[SEAL]

Columbus, Ohio, July 28, 1934.

## RESOLUTION PASSED BY THE FACULTY OF THE MARQUETTE UNIVERSITY DENTAL SCHOOL

WHEREAS, trade journalism and trade journals tend to commercialize the professional aspects of dentistry and therefore lower its standing as a profession, and

WHEREAS, journals supported by the American Dental Association and other dental societies and groups are striving to maintain the present high status of dentistry and are worthy and in need of undivided encouragement by the members of the dental profession; therefore, be it

*Resolved,* by the members of the Marquette University Dental School Faculty that no member of their group will in the future contribute to the support of a trade dental journal as an editor or writer either directly or through the proceedings of dental societies whose transactions are published in dental trade journals.

R. G. HAUKOHL, *Secretary.*

June 4, 1934.

# ANNOUNCEMENTS*

## CALENDAR OF MEETINGS

American Dental Association, New Orleans, La.

American Dental Society of Europe, London, July 31-August 3.

Belgian National Dental Congress, Brussels, August.

Mid-Southern Postgraduate Dental Clinic, Memphis, Tenn., October 22-24.

Montreal Dental Club Clinic, October 18-20.

New England Dental Society, Boston, Mass., October 17-18.

New York Dental Centennial, New York City, December 3-7.

Southwestern Society of Orthodontists, Abilene, Texas, October 15-17.

Odontological Society of Western Pennsylvania, Pittsburgh, Pa., November 7-9.

Society for Advancement of General Anesthesia in Dentistry, New York City, third Monday in February, April, October and December.

District of Columbia at George Washington University, Washington, D. C., second and fourth Tuesdays in each month from October to June, inclusive.

### STATE SOCIETIES

May

Illinois, at Quincy (14-16)

### STATE BOARD OF DENTAL EXAMINERS

California, at San Francisco, December 3. K. I. Nesbitt, 450 McAllister St., San Francisco, Secretary.

Connecticut, at Hartford, November 21-24. Almond J. Cutting, Southington, Secretary.

Delaware, at Wilmington, January 23-24. W. S. P. Combs, Middleton, Secretary.

Indiana, at Indianapolis, October 29-November 2. J. M. Hale, Mt. Vernon, Secretary.

Iowa, at Iowa City, December 17-20. Hardy F. Pool, Mason City, Secretary.

New Jersey, at Trenton, December 3-8. John C. Forsyth, 148 W. State St., Trenton, Secretary.

Massachusetts, at Boston, November 19-21. W. Henry Grant, State House, Boston, Secretary.

Wisconsin, at Milwaukee, December 10-14. S. F. Donovan, Tomah, Secretary.

### NEW ENGLAND DENTAL SOCIETY

The fortieth annual meeting of the New England Dental Society will be held in the Forsyth Dental Infirmary, Boston, Mass., October 17-18.

JOSEPH A. BRAY, *Secretary,*
99 Pratt St.
Hartford, Conn.

### DELAWARE STATE BOARD OF DENTAL EXAMINERS

The next regular meeting of the Delaware State Board of Dental Examiners will be held January 23-24 in the Delaware Hospital, 14th and Washington streets, Wilmington. For further information, apply to

W. S. P. COMBS, *Secretary,*
Middleton.

### MASSACHUSETTS BOARD OF DENTAL EXAMINERS

The Massachusetts Board of Dental Examiners will hold an examination for registration of dentists and hygienists in the City of Boston, November 19-21. Full information, application blanks, etc., can be obtained by applying to W. Henry Grant, Secretary, Room 141, State House, Boston. All applications must be filed at the office

*Announcements must be received by the fifth day of the month in order to be published in the forthcoming issue of THE JOURNAL.

of the secretary at least ten days before date set for examination.

### WISCONSIN STATE BOARD OF DENTAL EXAMINERS

The next meeting of the Wisconsin State Board of Dental Examiners for examination of applicants to practice in Wisconsin will be held at Marquette University Dental Department, Milwaukee, December 10-14.

S. F. DONOVAN, *Secretary,*
Tomah.

### NEW YORK DENTAL CENTENNIAL

This meeting in celebration of the hundredth anniversary of the founding of the first dental society, "The Society of Surgeon Dentists of the City and State of New York," will be held December 3-7 at the Hotel Pennsylvania, New York City. Address New York Dental Centennial Commission Offices, Hotel Pennsylvania, New York City.

### SOUTHWESTERN SOCIETY OF ORTHODONTISTS

The 1934 meeting of the Southwestern Society of Orthodontists will be held in Abilene, Texas, October 15-17.

CURTIS WILLIAMS, *Secretary,*
Medical Arts Bldg.,
Shreveport.

### ST. LOUIS STUDY CLUB OF DENTISTRY

The St. Louis Study Club of Dentistry offers the following courses for the 1934-1935 term, beginning October 17: oral diagnosis and diseases of the mouth; operative dentistry; crown and inlay casting technic; inflammatory processes of the gingiva; conductive and local anesthesia; crown and bridge: ceramics; all cast removable bridgework; roentgenology; practical speaking.

W. E. KLING, *Secretary,*
705 N. Kingshighway,
St. Louis.

### MOUNT SINAI HOSPITAL LECTURE COURSE IN DENTAL MEDICINE

The fourth lecture course in dental medicine to be given at Mount Sinai Hospital, New York City, will open October 9, with a lecture on physical diagnosis and clinical observations in relation to dental conditions, by Ernst Boas. November 13, Samuel Geist will speak on the importance of prenatal care; December 11, Harry Sobotka, on the chemistry of the saliva and its influence on the tissues; January 8, Paul Klemperer, on the histopathologic studies of the dental tissues; February 12, Philip Finkle, on arthritis and the teeth; March 12, Albert A. Berg, on treatment of oral surgical lesions from the viewpoint of the general surgeon; April 9, Harry A. Goldberg, on dental infections, their significance and treatment, local and systemic. All lectures commence at 8:30 p. m. They are held on the third floor of the Main Building and clinical cases of interest are presented before each lecture. All members of the medical and dental professions are invited to attend.

RALPH HOWARD BRODSKY, *Secretary,*
Dental Department,
Mt. Sinai Hospital,
New York City.

### ALPHA OMEGA FRATERNITY

The twenty-seventh annual convention of the Alpha Omega Fraternity will be held at the Ambassador Hotel, Atlantic City, N. J., December 23-25. Address all inquiries to

ABRAM COHEN, *Marshal,*
4727 Rising Sun Ave.
Philadelphia, Pa.

### DENTAL INSTRUMENTS STOLEN

Jacob Reich, D.D.S., 60 Park Place, Newark, N. J., has reported to the department of public safety, Newark, the loss of dental instruments valued at $750 through a burglary. Members of the profession are notified to be on the lookout for these instruments of all and any type used in extraction work.

JAMES A. MCRELL,
Chief of Police,
Department of Public Safety,
Newark, N. J.

# PER CAPITA SUBSCRIPTION OF STATES TO RELIEF FUND

The total amount subscribed to the Relief Fund of the American Dental Association for the year ending June 30, 1934 was $12,437.28. This is an average of only 40 cents per member.

The following is the per capita subscription for each state:

| | | | |
|---|---|---|---|
| Alabama | $0.13 | Montana | .35 |
| Arizona | .62 | Navy | .30 |
| Arkansas | .10 | Nebraska | .17 |
| Army | .30 | New Hampshire | .40 |
| California State | .26 | New Jersey | .39 |
| California South | .31 | New Mexico | .62 |
| Colorado | .30 | New York | .87 |
| Connecticut | .43 | North Carolina | .29 |
| Delaware | .79 | North Dakota | .76 |
| District of Columbia | 1.55 | Ohio | .34 |
| Florida | .38 | Oklahoma | .13 |
| Georgia | .20 | Oregon | .44 |
| Idaho | .28 | Panama Canal Zone | .27 |
| Illinois | .35 | Pennsylvania | .42 |
| Indiana | .27 | Rhode Island | .40 |
| Iowa | .26 | South Carolina | .11 |
| Hawaii | .41 | South Dakota | .12 |
| Kansas | .16 | Tennessee | .18 |
| Kentucky | .31 | Texas | .21 |
| Louisiana | .22 | Utah | .26 |
| Maine | .35 | U. S. Public Health Service | .18 |
| Maryland | .35 | U. S. Veterans Bureau | .11 |
| Massachusetts | .36 | Vermont | .26 |
| Michigan | .17 | Virginia | .33 |
| Minnesota | .32 | Washington | .28 |
| Mississippi | .12 | West Virginia | .25 |
| Missouri | .86 | Wisconsin | .26 |
| | | Wyoming | .64 |

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